



**National Aeronautics and
Space Administration
Langley Research Center**

**Scientific and Technical
Information Program Office**

Scientific and Technical Aerospace Reports

STAR

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Introduction

Scientific and Technical Aerospace Reports (STAR) is an online information resource listing citations and abstracts of NASA and world wide aerospace-related STI. Updated biweekly, *STAR* highlights the most recent additions to the NASA Aeronautics and Space Database. Through this resource, the NASA STI Program provides timely access to the most current aerospace-related Research & Development (R&D) results.

STAR subject coverage includes all aspects of aeronautics and space research and development, supporting basic and applied research, and application, as well as aerospace aspects of Earth resources, energy development, conservation, oceanography, environmental protection, urban transportation and other topics of high national priority. The listing is arranged first by 11 broad subject divisions, then within these divisions by 76 subject categories and includes two indexes: subject and author.

STAR includes citations to Research & Development (R&D) results reported in:

- NASA, NASA contractor, and NASA grantee reports
- Reports issued by other U.S. Government agencies, domestic and foreign institution, universities, and private firms
- Translations
- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses

The NASA STI Program

The NASA Scientific and Technical Information (STI) Program was established to support the objectives of NASA's missions and research to advance aeronautics and space science. By sharing information, the NASA STI Program ensures that the U.S. maintains its preeminence in aerospace-related industries and education, minimizes duplication of research, and increases research productivity.

Through the NASA Center for AeroSpace Information (CASI), the NASA STI Program acquires, processes, archives, announces and disseminates both NASA's internal STI and world-wide STI. The results of 20th and 21st century aeronautics and aerospace research and development, a worldwide investment totaling billions of dollars, have been captured, organized, and stored in the NASA Aeronautics and Space Database. New information is continually announced and made available as it is acquired, making this a dynamic and historical collection of value to business, industry, academia, federal institutions, and the general public.

The STI Program offers products and tools that allow efficient access to the wealth of information derived from global R&D efforts. In addition, customized services are available to help tailor this valuable resource to meet your specific needs.

For more information on the most up to date NASA STI, visit the STI Program's website at <http://www.sti.nasa.gov>.

NASA STI Availability Information

NASA Center for AeroSpace Information (CASI)

Through NASA CASI, the NASA STI Program offers many information products and services to the aerospace community and to the public, including access to a selection of full text of the NASA STI. Free registration with the program is available to NASA, U.S. Government agencies and contractors. To register, contact CASI at help@sti.nasa.gov. Others should visit the program at www.sti.nasa.gov. The 'search selected databases' button provides access to the NASA Technical Reports Server (TRS) – the publicly available contents of the NASA Aeronautics and Space Database.

Each citation in *STAR* indicates a 'Source of Availability'. When CASI is indicated, the user can order this information directly from CASI using the [STI Online Order Form](#) or contact help@sti.nasa.gov or telephone the CASI Help Desk at 301-621-0390. Before ordering you may access price code tables for STI [documents](#) and [videos](#). When information is not available from CASI, the source of the information is indicated when known.

NASA STI is also available to the public through Federal information organizations. NASA CASI disseminates publicly available NASA STI to the National Technical Information Service (NTIS) and to the Federal Depository Library Program (FDLP) through the Government Printing Office (GPO). In addition, NASA patents are available online from the U.S. Patent and Trademark Office.

National Technical Information Service (NTIS)

The National Technical Information Service serves the American public as a central resource for unlimited, unclassified U.S. Government scientific, technical, engineering, and business related information. For more than 50 years NTIS has provided businesses, universities, and the public timely access to well over 2 million publications covering over 350 subject areas. Visit NTIS at <http://www.ntis.gov>.

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The U.S. Patent and Trademark Office (USPTO)

The U.S. Patent and Trademark Office provides online access to full text patents and patent applications. The database includes patents back to 1976 plus some pre-1975 patents. Visit the USPTO at <http://www.uspto.gov/patft/>.

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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VOLUME 44, FEBRUARY 24, 2006

02 AERODYNAMICS

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans, and other elements of turbomachinery. For related information see also 34 Fluid Mechanics and Thermodynamics.

20060005692 Federal Aviation Administration, Washington, DC USA

Aeronautical Information Manual: Official Guide to Basic Flight Information and ATC Procedures

Feb. 19, 2004; 552 pp.; In English

Report No.(s): PB2006-103701; No Copyright; Avail.: National Technical Information Service (NTIS)

This manual is designed to provide the aviation community with basic flight information and ATC procedures for use in the National Airspace System (NAS) of the USA. An international version called the Aeronautical Information Publication contains parallel information, as well as specific information on the international airports for use by the international community. This manual contains the fundamentals required in order to fly in the USA NAS. It also contains items of interest to pilots concerning health and medical facts, factors affecting flight safety, a pilot/controller glossary of terms used in the ATC System, and information on safety, accident, and hazard reporting. This manual is complemented by other operational publications which are available via separate subscriptions.

NTIS

Air Traffic Control; Information; Manuals; National Airspace System

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; airport ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in 09 Research and Support Facilities (Air). Air traffic control is covered in 04 Aircraft Communications and Navigation. For related information see also 16 Space Transportation and Safety and 85 Technology Utilization and Surface Transportation.

20060005676 Transportation Security Administration, Washington, DC, USA

Test and Evaluation Plan: Physical Search of Checked Bags with and without Image Guidance

Maguire, W.; Klock, B.; Oct. 2003; 16 pp.; In English

Contract(s)/Grant(s): DTFA03-02-D-00021

Report No.(s): PB2006-101629; TSL-200; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This Test and Evaluation Plan outlines the procedures for the Bag Search Baseline Study. The study will be conducted at the Transportation Security Administration (TSA) Security Optimization Human Factors Integration and Evaluation Laboratory. Twenty screeners will each physically search 50 bags half with and half without the printed images of EDS alarms using TSA standard operating procedures for physical search of EDS alarm bags. The effectiveness, thoroughness, and efficiency of bag search with and without the printed images of EDS alarms will be recorded and analyzed.

NTIS

Airline Operations; Baggage; Bags; Evaluation; Security; System Effectiveness; Transportation

20060005684 Transportation Security Administration, Washington, DC, USA

Operational Test of Commercially Available UHF Radio Frequency Identification (RFID) Systems for Baggage Identification, Tracking and Security Applications. Worldwide UHF RFID Interoperability Trial

Cerino, A. T.; Aug. 2005; 60 pp.; In English

Contract(s)/Grant(s): DTFACT-03-C-00042

Report No.(s): PB2006-101634; DHS/TSA/TSL-05/75; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This report summarizes the results of the Worldwide UHF RFID Interoperability Trial, conducted by the TSA in June and July of 2005. The trial was held in the following international airports: Chicago, Amsterdam, Narita, Beijing, and Nairobi. Its purpose was to test RFID passenger baggage tag interoperability among the following UHF frequencies: (902-928 MHz) U.S., (865-868 MHz) Europe, and (952-954 MHz) Japan. The test results positively demonstrated the RFID baggage tag worldwide frequency interoperability. Secondly, the test showed the applicability of EPC global standards to the tracking of airline baggage between multiple airports, and the sharing of that data across the world.

NTIS

Baggage; Interoperability; Radio Frequencies; Security; Ultrahigh Frequencies

20060005686 Transportation Security Administration, Washington, DC, USA

Elevated Podium for Integrated Checkpoint Security Supervision Usability Test and Evaluation Plan

Snyder, M. D.; Aug. 2002; 42 pp.; In English

Report No.(s): PB2006-101632; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This test and evaluation plan details the usability evaluation for the Elevated Podium for Integrated Checkpoint Security Supervision (EPICSS). The EPICSS provides Checkpoint Security Supervisors (CSSs) with current, state-of-the-art, electronic management tools to more effectively manage and monitor the security checkpoint. The EPICSS is designed to provide CSSs with quantitative data, real-time video images of X-ray monitors, and security cameras to determine security screener performance, as well as equipment status. The objective of this study is to perform an ergonomic evaluation of the EPICSS at the Seattle-Tacoma International Airport, conduct a usability evaluation of each system installed in the EPICSS, assess whether the necessary information for increasing checkpoint security is available and usable by CSSs, and elicit information that could improve its design.

NTIS

Airport Security; Evaluation; Personnel Management; Security; System Effectiveness

20060005690 Transportation Security Administration, Washington, DC, USA

Role of Attention in Visual Search: Long-Term Research Report

Rubinstein, J.; Oct. 2003; 24 pp.; In English

Report No.(s): PB2006-101630; DHS/TSA/TSL-06/08; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report includes a review of the results of three experiments conducted by researchers at Johns Hopkins University under a Federal Aviation Administration research grant. This research supports the Transportation Security Laboratory's Human Factors Long-Term Research Program. The purpose of this research is to develop a theoretical understanding of the cognitive processes involved in various security tasks. The research described in this report is most relevant to the X-ray screener search task. Experiment 1 examined the effects of size and brightness on the unintentional capture of attention during a target search task. Unintentional capture occurs when a non-target draws attention away from the target. Experiment 2 examined basic search processes by looking at how the placement of multiple targets effects detection. Experiment 3 addressed the different types of search strategies a screener might use during a search task.

NTIS

Cognition; Security; Visual Perception

20060005698 Federal Aviation Administration, Washington, DC USA

Regulatory/Non-Regulatory Special Use Airspace Areas

Aug. 04, 2005; 196 pp.; In English

Report No.(s): PB2006-103420; No Copyright; Avail.: CASI: [A09](#), Hardcopy

This compilation, published semi-annually, provides a listing of all regulatory and non-regulatory special use airspace areas, as well as issued but not yet implemented amendments to those areas, established by the Federal Aviation Administration (FAA). This publication is distributed to select offices in Washington Headquarters, Regional Air Traffic Organization Service Areas, Air Route Traffic Control Centers, and interested aviation parties.

NTIS

Airspace; Air Traffic Control

20060005718 Transportation Security Administration, Washington, DC, USA

Test and Evaluation Plan: Screener Effectiveness of Monetary/Non-Monetary Incentives

Klock, B. A.; Jul. 2004; 60 pp.; In English

Report No.(s): PB2006-101662; DHS/TSA/TSL-06/04; No Copyright; Avail.: CASI: [A04](#), Hardcopy

There is currently no set incentive program for the Transportation Security Administration to use to reward screeners, and little or no data has been collected that indicates whether an incentive program would improve threat detection or morale. This test and evaluation plan describes an assessment of monetary and non-monetary screener incentives based on Threat Image Projection (TIP) data to enhance screener feedback and detection performance. Only certified X-ray operators will participate. These operators are current security employees who are assigned to perform X-ray security monitoring on the TIP X-ray machines. TIP will randomly insert an image of a threat object into a passenger carry-on bag at the current ratio, as a means to assess screener threat detection performance. Two incentive programs will be developed and compared. One will include a monetary reward for screener performance at the end of each month. The other will include detailed and enhanced feedback to the screeners regarding their ongoing on the job performance. Further, the study will compare these incentive programs using both individual and team-based performance.

NTIS

Evaluation; Human Performance; Incentives; Motivation; System Effectiveness; Tasks

20060005739 Federal Aviation Administration, Atlantic City, NJ, USA

Newark Liberty International Airport (ERW) Vehicle Tracking Demonstration Wireless Fleet Management System, Final Report

Cerino, A. T.; Jun. 2005; 216 pp.; In English

Contract(s)/Grant(s): DTFA-CT-03-C-00042

Report No.(s): PB2006-101636; TSA/TSL-300; No Copyright; Avail.: CASI: [A10](#), Hardcopy

The Wireless Fleet Management System (WFMS) has been installed at Newark Liberty International Airport (EWR) in a trial version as a technology demonstration and evaluation program that implements radio frequency identification (RFID) based tracking of the location of port-owned vehicles, ground support equipment (GSE), and commercial (vendor) fuel trucks on the surface areas of the airport. This technology is effective against some insider threat tactics as well as the threat of a stolen or hijacked ramp vehicle used for terrorist actions. The overall objective of this operational evaluation effort is to demonstrate the capability of the vehicle tracking technology to operate in the radio frequency (RF)-rich environment of an airport operations area (AOA) on a moderate scale (approximately 80 vehicles). The testing was accomplished in a three-phase process. Testing was accomplished via methods of observation, demonstration, and data analysis, and covered all of the functional and system requirements of the WFMS. A test of the RF environment was also performed to validate antenna/gateway coverage during Phase Zero and Phase One.

NTIS

Airport Security; Airports; Management Systems; Radio Frequencies

20060005747 Federal Aviation Administration, Washington, DC USA

Report: Investigation of Security Screener Incentives and Benefits

Klock, B. A.; Feb. 2002; 30 pp.; In English

Report No.(s): PB2006-101661; DHS/TSA/TSL-06/11; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report presents the findings from the investigation of the types of incentives and benefits currently offered to aviation security screeners. A general survey was conducted to identify the types of incentives and benefit programs being utilized by screening companies. The survey was conducted prior to the federalization of the screener workforce to provide a snapshot of the current practices of screening companies. Although site-specific, screening companies appear to be making a concerted effort to satisfy the needs of their screening personnel. Through the effective utilization of well-designed incentives and benefits programs, the aviation industry and security screeners (both federal and private) could receive the desired outcomes from their respective employer-employee exchange relationships.

NTIS

Incentives; Personnel Management; Security

20060005752 Transportation Security Administration, Washington, DC, USA

Operational Test of Commercially Available UHF Radio Frequency Identification (RFID) Systems for Baggage Identification, Tracking and Security Applications, U.S./Europe UHF RFID Interoperability Trial

Cerino, A. T.; Aug. 13, 2004; 70 pp.; In English

Report No.(s): PB2006-101635; DHS/TSA/TSL-05/77; No Copyright; Avail.: CASI: [A04](#), Hardcopy

This document represents the Final Report of a Ultrahigh Frequency (UHF) Radio Frequency Identification (RFID) Baggage Tag Interoperability Trial conducted between the U.S. and Europe. In particular, the trial evaluated the ability of

EPCglobal Class 0+ UHF RFID baggage tags to be programmed at one of the U.S. frequencies (902 to 928 MHz) and flown from Philadelphia on US Airways flights to Rome, Italy and subsequently read on arrival in Rome at one of the European frequencies (865 to 868 MHz). The same procedure was done on the return Rome to Philadelphia flights. This trail clearly demonstrated the 'low end and middle UHF Industrial, Scientific and Medical (ISM) band interoperability' that was its primary objective.

NTIS

Baggage; Europe; Interoperability; Radio Frequencies; Security; Ultrahigh Frequencies

20060006424 Federal Aviation Administration, Washington, DC USA

Report to Congress: Aviation Security Aircraft Hardening Program

Dec. 1998; 14 pp.; In English

Report No.(s): PB2006-103418; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This report is submitted in response to language in Senate Report 102-351 accompanying the Department of Transportation Appropriations Act for Fiscal Year 1993. The Federal Aviation Administration (FAA) was asked to study different types of technology designed to protect aircraft against certain explosives and to report to the Appropriations Committees on its findings. The FAA was also asked to consider investment and operating costs, acceptable safety margins, passenger convenience, and any other relevant factors. Interim reports were submitted to the Appropriations Committees in September 1994 and March 1996. This report provides a current assessment and review of the research work completed to date regarding one such technology, hardened containers.

NTIS

Commercial Aircraft; Security; Air Transportation

04

AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also 06 Avionics and Aircraft Instrumentation; 17 Space Communications, Spacecraft Communications, Command and Tracking; and 32 Communications and Radar.

20060006319 Defence Science and Technology Organisation, Melbourne, Australia

Detection and Identification of Simultaneous Communications in a Simulated Flying Task

McAnally, Ken; Martin, Russell; Doman, Jodie; Eberle, Geoff; Parker, Simon; New Directions for Improving Audio Effectiveness; April 2005, pp. 31-1 - 31-6; In English; See also 20060006290; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Operators of military flight vehicles are often required to attend to more than one source of communications signal. Previous research has shown that the intelligibility of a speech message in a background of speech distractors is improved if the signals are presented using a 3-dimensional (3-d) audio display rather than the traditional diotic configuration. However, whether infrequent target messages (e.g., callsigns) are more reliably detected in a continuous monitoring task with high temporal uncertainty when using a 3-d audio display has not been examined. This study examined participants' ability to detect a target callsign and identify a colour/number combination associated with it while engaged in a 20-minute, simulated formation-flying task. Participants were required to monitor 5 communications channels in each of which messages were presented at random intervals. (On average, 2.4 channels were simultaneously active.) Thirty targets were presented over the 20-minute period. There were three audio display conditions: diotic, all channels in front, and channels separated in azimuth (3-d). Detection of target callsigns was significantly higher in the 3-d condition compared to the other conditions. Detections and false alarms were combined to calculate sensitivity and criterion measures using signal detection theory. Sensitivity was significantly higher in the 3-d condition compared with the other conditions, but there were no differences in criterion. Also, consistent with previous results, correct identification of the target number/colour combination was significantly higher in the 3-d condition compared with the other conditions.

Author

Signal Detection; Channels (Data Transmission); Formation Flying; Intelligibility; Azimuth

05

AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance and evaluation, and aircraft and flight simulation technology. For related information see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles see 85 Technology Utilization and Surface Transportation.

20060005691 Federal Aviation Administration, Washington, DC USA

New York Terminal Radar Approach Control (TRACON) Operational Assessment (March 2-May 6, 2005) (Includes Executive Summary)

Jun. 02, 2005; 118 pp.; In English

Report No.(s): PB2006-103702; No Copyright; Avail.: National Technical Information Service (NTIS)

On March 2, 2005, the Federal Aviation Administration convened a team of safety experts, investigators, current and former air traffic controllers, and human resource and finance professionals to begin a 60-day on-site operational assessment of its New York Terminal Radar Approach Control (the New York TRACON) facility. This document is a summary of their findings and recommendations.

NTIS

Air Transportation; Airports; Radar Approach Control; Terminal Guidance

06

AVIONICS AND AIRCRAFT INSTRUMENTATION

Includes all avionics systems, cockpit and cabin display devices, and flight instruments intended for use in aircraft. For related information see also 04 Aircraft Communications and Navigation; 08 Aircraft Stability and Control; 19 Spacecraft Instrumentation and Astrionics; and 35 Instrumentation and Photography.

20060006316 Air Force Research Lab., Wright-Patterson AFB, OH, USA

Spatial Audio Displays for Improving Safety and Enhancing Situation Awareness in General Aviation Environments
Simpson, Brian D.; Brungart, Douglas S.; Gilkey, Robert H.; McKinley, Richard L.; New Directions for Improving Audio Effectiveness; April 2005, pp. 26-1 - 26-15; In English; See also 20060006290; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Most current displays in general aviation (GA) environments employ, at best, relatively simple audio displays that do not fully exploit the operator's sensory processing capabilities, and thus may not allow pilots to take full advantage of the available information. This paper describes a series of four experiments conducted in an actual flight environment at the USAF Test Pilot school that evaluate the utility of spatial auditory displays as a navigation aid and an attitude indicator. Performance was measured in tasks that required pilots to fly in the direction of a spatial audio 'navigation beacon,' and use an auditory artificial horizon display to detect changes in attitude and maintain straight and level flight when no visual cues were available. The results from these studies indicate that spatial audio displays can effectively be used by pilots for both navigation and attitude monitoring. In addition, because the stimulus employed in the audio horizon display was self-selected music, pilot acceptance was high and it was possible to provide ongoing information to the pilot without the risk of annoyance. Although performance with standard display configurations remains superior, spatial audio displays may be used to supplement these existing displays, and to provide cues when critical information is either obscured or missing, such as in low-visibility conditions or when the pilot's attention is focused on another task. Thus it appears that spatial audio may be used to support situation awareness and improve overall safety in the general aviation environment.

Author

Display Devices; Navigation Aids; Visibility; General Aviation Aircraft; Attitude Indicators; Visual Stimuli

20060006330 Arizona State Univ., Tempe, AZ, USA, Honeywell Labs., Phoenix, AZ, USA

Safety and Certification Approaches for Ethernet-Based Aviation Databases

Lee, Y. H.; Rachlin, E.; Scandura, P. A.; Dec. 2005; 128 pp.; In English

Report No.(s): PB2006-103438; No Copyright; Avail.: National Technical Information Service (NTIS)

With the advent of higher-performance computing and communication systems, aircraft will have the capability to process an unprecedented amount of information pertaining to performance, safety, and efficiency. Flight instruments will be integrated to share information and to cooperate with each other. It is inevitable that a high-speed and versatile network infrastructure

will be required in the next generation of aircraft. One commercial off-the-shelf technology, Ethernet, is seen as potentially attractive in avionics systems due to its high bandwidth, low wire count, and low cost. Ethernet has been used in the Boeing 777 to transmit non-flight-critical data and in the Boeing 767ER within a flight-critical display system. There are many safety concerns, however, when Ethernet is applied to flight-critical systems. The inherent nature of the Ethernet protocols can easily result in nondeterministic behavior and interference. These are significant technical hurdles that must be overcome before Ethernet will be a viable candidate as an aviation databus technology.

NTIS

Avionics; Certification; Ethernet; Safety

07

AIRCRAFT PROPULSION AND POWER

Includes primary propulsion systems and related systems and components, e.g., gas turbine engines, compressors, and fuel systems; and onboard auxiliary power plants for aircraft. For related information see also 20 Spacecraft Propulsion and Power; 28 Propellants and Fuels; and 44 Energy Production and Conversion.

20060006334 Naval Air Warfare Center, China Lake, CA, USA

Advanced Aircraft Materials, Engine Debris Penetration Testing

Lundin, S. J.; Mueller, R. B.; Dec. 2005; 96 pp.; In English

Report No.(s): PB2006-103437; No Copyright; Avail.: National Technical Information Service (NTIS)

This report documents the results of testing conducted in July and August 2001 at the Naval Air Warfare Center-Weapons Division, China Lake, CA, as part of the continued effort to characterize uncontained engine events. This effort was performed in support of the Federal Aviation Administration Aircraft Catastrophic Failure Prevention Program. Data generated from this test will support the penetration equation development for the Uncontained Engine Debris Damage Analysis Model (UEDDAM), a developmental design tool for conducting aircraft safety analysis for engine rotor burst events. This testing investigated composite materials and metals for use in component shielding applications. Previous testing had focused on aircraft skins and structural components. Four materials were investigated during this series of testing: 2024-T351 aluminum, Ti-6Al-4V titanium, Inconel(Trade Name) 625 low-cycle fatigue, and a generalized composite. Impact data from these materials was used to characterize the ballistic response via a material constant within the penetration equations. This material property was previously denoted as the dynamic shear modulus. Examination of the ballistic limit equation used within the UEDDAM has determined that the material constant is more appropriately a shear constant.

NTIS

Debris; Engine Tests; Penetration

12

ASTRONAUTICS (GENERAL)

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see *categories 13 through 20*. For extraterrestrial exploration see *91 Lunar and Planetary Science and Exploration*.

20060006427 Institute of Space Medico-Engineering, Beijing, China

Space Medicine and Medical Engineering (Hangtian Yu Yixue Gongcheng), Vol. 18, No. 5, October 2005

Wei, J. H.; Oct. 2005; 88 pp.; In Chinese

Report No.(s): PB2006-101709; Copyright; Avail.: National Technical Information Service (NTIS)

;Partial Contents: Effects of Tail Suspension on Phosphorylation Status of ERK1/2 in Rat Soleus Muscle(In English); Hemispheric Asymmetry for Encoding Unrelated Word Pairs. A Functional Near-infrared Spectroscopy Study(In English); Effects of Simulated Microgravity on Morphology of Human Umbilical Vein Endothelial Cells and Its Production of NO; Effects of K Channel Alteration on Fatigability of High-frequency Tetanic Contraction in Mouse; Application of Multislice Spiral CT(MSCT) in Studies of Multi-organ Injury under +Gx in Rhesus Monkey; Biodestructive Capability of Several Microorganisms on Space Structural Materials in Space; Comparison Study of Impact Response Characteristics between SZM510 Dummy and Hybrid; Experimental Study of Special Long-effect Controlled-releasing Fertilizers in Controlled Ecological Life Support System; Acoustic Features Analysis of Mandarin Speech under Various Emotional Status; A3-2 Continuous Free-flow Electrophoresis Device for Separation of Model Proteins; Medical Panorama from X-ray Images Based

on Mosaicing Technique; Feasibility Study of Ultrasonic Backscatter Coefficient in Assessment of Cancellous Bone; Automatic Recognition of Rat's Postures Based on Naive Bayes Classifier; Feasibility Study of Mental Fatigue Grade Based on Kolmogorov Entropy; Effects and Mechanisms of Isorhamnetin on Lung Carcinoma; Effects of Total Saponin of Panax Ginseng on Epo/EpoR in Model Mice with Myelosuppression.

NTIS

Aerospace Medicine; Medical Services

20

SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information see also *07 Aircraft Propulsion and Power*, *28 Propellants and Fuels*, *15 Launch Vehicles and Launch Operations*, and *44 Energy Production and Conversion*.

20060005661 Integrated Concepts and Research Corp., Sterling Heights, MI, USA

Annual Report for the Ultra-Clean Fischer-Tropsch Fuels Production and Demonstration Project. (Report for July 20, 2004-July 20, 2005)

Bergin, S.; Oct. 14, 2005; 330 pp.; In English

Report No.(s): DE2005-860805; No Copyright; Avail.: National Technical Information Service (NTIS)

The Report Abstract provides summaries of the past year's activities relating to each of the main project objectives. Some of the objectives will be expanded on in greater detail further down in the report. The following objectives have their own addition sections in the report: Dynamometer Durability Testing, the Denali Bus Fleet Demonstration, Bus Fleet Demonstrations Emissions Analysis, Impact of SFP Fuel on Engine Performance, Emissions Analysis, Feasibility Study of SFPs for Rural Alaska, and Cold Weather Testing of Ultra Clean Fuel.

NTIS

Clean Fuels; Fischer-Tropsch Process; Fuel Production; Fuels

23

CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see *categories 25 through 29*. For astrochemistry see category *90 Astrophysics*.

20060005602 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands

Practical Evaluation of the Performance of the Manportable Automatic Chemical Alarm Detector System B (ACADS System B) for the Detection of Eight Toxic Industrial Chemicals (TICS)

Olivier, R. C. M.; Harteveld, J. L. N.; Zappey, H. W.; October 2005; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): TNO Proj. 014.16789

Report No.(s): TD2000-099; TNO-DV2 2005 A099; Copyright; Avail.: Other Sources

Description of the results of a practical evaluation of the selected ACADS System B detector, GID-M, for the vapour detection of eight selected toxic industrial chemicals. The goal of the laboratory testing and evaluation project was confirmation of the compliance of GID-M to the specific TIC detection requirements. The assessment of the sensitivity evaluation factors such as detection limit and response time is based on the Immediate Danger to Life and Health Level (IDLH) versus the detection range of the detector. This to confirm whether or not the detector would be capable of detecting and warn for the presence of the selected TICs at the required IDLH level.

Author

Toxicity; Chemical Composition; Hazards; Proving

20060005682 National Energy Technology Lab., Pittsburgh, PA USA, Electric Power Research Inst., Palo Alto, CA, USA
Speciation and Attenuation of Arsenic and Selenium at Coal Combustion By-Product Management Facilities. (Annual Report, October 1, 2002-September 30, 2003)

Patton, R.; Ladwig, K.; Hensel, B.; Wallschlager, D.; Lee, L.; January 2005; 22 pp.; In English

Report No.(s): DE2005-860441; No Copyright; Avail.: National Technical Information Service (NTIS)

Following completion of contracting activities, sites were identified for the field leachate characterization study. Sampling

and Analyses Plans (SAPs) and Site Access Agreements (SAAs) were developed for each site. A total of ten sites were sampled during this reporting period: five landfills, four ponds, and one minefill. Trace element concentrations are available for all ten sites, but speciation analyses have not yet been completed. Sample analyses for the first ten sites will be substantially completed by the end of December. Additional field sampling begins in October 2003 and will continue through the summer of 2004.

NTIS

Arsenic; By-Products; Coal; Combustion Chambers; Selenium

20060005696 National Toxicology Program, Research Triangle Park, NC, USA

NTP Report on the Toxicology Studies of Aspartame (CAS NO. 22839-47-0) in Genetically Modified (FVB Tg.AC Hemizygous) and B6.129-Cdkn2a(tm1Rdp) (n2) Deficient Mice and Carcinogenicity Studies of Aspartame in Genetically Modified (B6.129-trp53(tm1Brd)(n5) Haploinsufficient) Mice (Feed Studies)

Oct. 2005; 228 pp.; In English

Report No.(s): PB2006-103430; NIH/PUB-06-4459; No Copyright; Avail.: CASI: [A11](#), Hardcopy

The studies described in this report are designed and conducted to characterize and evaluate the toxicologic potential, including carcinogenic activity, of selected chemicals in laboratory animals (usually two species, rats and mice). Chemicals selected for NTP toxicology and carcinogenesis studies are chosen primarily on the bases of human exposure, level of production, and chemical structure. The interpretive conclusions presented in this Technical Report are based only on the results of these NTP studies. Extrapolation of these results to other species and quantitative risk analyses for humans require wider analyses beyond the purview of these studies. Selection per se is not an indicator of a chemical's carcinogenic potential.

NTIS

Carcinogens; Mice; Nitrogen; Toxicology

20060005697 Bureau of the Census, Washington, DC, USA

Economic Census 2002: Manufacturing, Industry Series. Leather and Hide Tanning and Finishing

Jan. 2005; 50 pp.; In English

Report No.(s): PB2006-103213; EC02-31I-316110(RV); No Copyright; Avail.: CASI: [A03](#), Hardcopy

The economic census is the major source of facts about the structure and functioning of the nation's economy. It provides essential information for government, business, industry, and the general public. Title 13 of the USA Code (Sections 131, 191, and 224) directs the Census Bureau to take the economic census every 5 years, covering years ending in 2 and 7. The economic census furnishes an important part of the framework for such composite measures as the gross domestic product estimates, input/output measures, production and price indexes, and other statistical series that measure short-term changes in economic conditions.

NTIS

Census; Economic Analysis; Economics; Industries; Leather; Manufacturing

20060005699 Bureau of the Census, Washington, DC, USA

Economic Census 2002: Manufacturing, Industry Series. All Other Cut and Sew Apparel Manufacturing

Dec. 2004; 50 pp.; In English

Report No.(s): PB2006-103209; EC02-31I-315299(RV); No Copyright; Avail.: CASI: [A03](#), Hardcopy

The economic census is the major source of facts about the structure and functioning of the nation's economy. It provides essential information for government, business, industry, and the general public. Title 13 of the USA Code (Sections 131, 191, and 224) directs the Census Bureau to take the economic census every 5 years, covering years ending in 2 and 7. The economic census furnishes an important part of the framework for such composite measures as the gross domestic product estimates, input/output measures, production and price indexes, and other statistical series that measure short-term changes in economic conditions.

NTIS

Census; Clothing; Cutting; Economic Analysis; Economics; Industries; Manufacturing

20060005700 Brookhaven National Lab., Upton, NY USA

Selective Solvent-induced Reversible Surface Reconstruction of Diblock Copolymer Thin Films

Brennan, J. M.; Blaskiewicz, M. M.; Sep. 2005; 16 pp.; In English

Report No.(s): DE2005-15020512; BNL-75047-2005-CP; No Copyright; Avail.: Department of Energy Information Bridge

Through the use of a selective solvent a reversible surface reconstruction of diblock copolymer thin films was observed. The solvent selectivity and solubility of the minor component block were found to be crucial to generate nanoporous films with pores that penetrate through entire film thickness. The process was shown to be reversible by thermal annealing and was easily monitored using in-situ grazing incidence small angle x-ray scattering and scanning force microscopy. At temperatures of 60-90deg C, only a small fraction of the nanopores relaxed to regenerate the original nanotemplate. However, by heating to 90-100 deg C, the original nanotemplate was completely regenerated. Even though the bulk mobility of PS and PMMA is low at these temperatures, the local mobility required to regenerate the template was sufficient.

NTIS

Copolymers; Solvents; Thin Films

20060005701 Bureau of the Census, Washington, DC, USA

Economic Census 2002: Manufacturing, Industry Series. Fur and Leather Apparel Manufacturing

Dec. 2004; 50 pp.; In English

Report No.(s): PB2006-103208; EC02-31I-315292(RV); No Copyright; Avail.: CASI: [A03](#), Hardcopy

The economic census is the major source of facts about the structure and functioning of the nation's economy. It provides essential information for government, business, industry, and the general public. Title 13 of the USA Code (Sections 131, 191, and 224) directs the Census Bureau to take the economic census every 5 years, covering years ending in 2 and 7. The economic census furnishes an important part of the framework for such composite measures as the gross domestic product estimates, input/output measures, production and price indexes, and other statistical series that measure short-term changes in economic conditions.

NTIS

Census; Economic Analysis; Economics; Industries; Leather; Manufacturing

20060005704 Bureau of the Census, Washington, DC, USA

Economic Census 2002: Construction, Industry Series. Glass and Glazing Contractors

Dec. 2004; 50 pp.; In English

Report No.(s): PB2006-103100; EC02-23I-238150; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The economic census is the major source of facts about the structure and functioning of the nation's economy. It provides essential information for government, business, industry, and the general public. Title 13 of the USA Code (Sections 131, 191, and 224) directs the Census Bureau to take the economic census every 5 years, covering years ending in '2' and '7'. The economic census furnishes an important part of the framework for such composite measures as the gross domestic product estimates, input/output measures, production and price indexes, and other statistical series that measure short-term changes in economic conditions.

NTIS

Census; Classifications; Construction Industry; Contractors; Economic Analysis; Economics; Glass; Industries

20060005711 National Renewable Energy Lab., Golden, CO USA, Utah Univ., Salt Lake City, UT, USA

Characterization of Amorphous Silicon Advanced Materials and PV Devices. (Final Report, December 15, 2001-January 31, 2005)

Taylor, P.C.; von Roedern, B.; January 2005; 50 pp.; In English

Report No.(s): DE2005-860399; NREL/SR-520-38678; No Copyright; Avail.: Department of Energy Information Bridge

The major objectives of this subcontract have been (1) to understand the microscopic properties of the defects that contribute to the Staebler-Wronski effect in order to eliminate this effect, (2) to perform correlated studies on films and devices made by novel techniques, especially those with promise to improve stability or deposition rates, (3) to understand the structural, electronic and optical properties of films of hydrogenated amorphous silicon (a-Si:H) made on the boundary between the amorphous and microcrystalline phases, (4) to search for more stable intrinsic layers of a-Si:H, (5) to characterize the important defects, impurities, and metastabilities in the bulk and at surfaces and interfaces in a-Si:H films and devices and in important alloy systems, and (6) to make state-of-the-art plasma enhanced chemical vapor deposition (PECVD) devices out of new, advanced materials when appropriate. All of these goals are highly relevant to the improvement of photovoltaic (PV) devices based on a-Si:H and related alloys. With regard to the first objective, we have identified a paired hydrogen site that may be the defect that stabilizes the silicon dangling bonds formed in the Staebler-Wronski effect.

NTIS

Amorphous Silicon; Photovoltaic Conversion

20060005721 Forest Products Lab., Madison, WI USA

Experiments in Gluing Southern Pine Veneer

Mar. 1964; 42 pp.; In English

Report No.(s): PB2006-102799; FPL-032; No Copyright; Avail.: CASI: [A03](#), Hardcopy

For a number of years Douglas-fir has been the principal species used in the manufacture of softwood plywood, although a number of other western softwoods are now important. Recently, interest has developed in the use of southern pine for plywood, primarily for sheathing applications. The study reported here was undertaken to learn something of the gluing ability of this species as a plywood material, particularly in comparison with Douglas-fir.

NTIS

Conifers; Plywood; Veneers

20060005745 Lawrence Livermore National Lab., Livermore, CA USA

Kinetic Measurement and Prediction of the Hydrogen Outgassing from the Polycrystalline LiH/LiOH System

Dinh, L. N.; Grant, D. M.; Schildbach, M. A.; Smith, R. A.; Leckey, J. H.; January 2005; 12 pp.; In English

Report No.(s): DE2005-15015944; UCRL-PROC-210786; No Copyright; Avail.: National Technical Information Service (NTIS)

In this report, we present the use of temperature programmed reaction/decomposition (TPR) in the isoconversion mode to measure outgassing kinetics and to make kinetic prediction concerning hydrogen release from the polycrystalline LiH/LiOH system in the absence of any external H(sub 2)O source.

NTIS

Hydrogen; Outgassing; Polycrystals

20060005754 National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China

Journal of The Chinese Institute of Engineers. Special Issue: Chemical Engineering; Volume 28, No. 7

Chen, Shuh, Editor; Tsai, Hsien-Lung, Editor; Shiou, Fang-Jung, Editor; Lee, Liang-Sun; Young, Der-Liang, Editor; Pan, Ching-Tsai, Editor; Chen, Jean-Lien, Editor; Chung, Chung-Ping, Editor; Chao, Ching-Kong, Editor; Chang, Kai, Editor, et al.; November 2005; ISSN 0253-3839; 159 pp.; In English; See also 20060005755 - 20060005767; Original contains black and white illustrations; Copyright; Avail.: Other Sources

The papers in this Special Issue cover a wide spectrum of research areas in chemical engineering, ranging from determinations and estimations of thermodynamic and physical properties, which are more closely related to the once dominating oil and petrochemical industries, through materials engineering, environmental technology, transport phenomena, membrane reactors, catalytic reaction engineering, bio-separation to the two frontier areas in bioengineering: stem cell culture engineering and metabolic engineering. These wide-ranging areas mirror research currently on-going in chemical engineering and reflect the unique history of chemical engineering as a discipline. Since its emergence in the late 19th century as an interdisciplinary field between industrial chemistry and mechanical engineering, chemical engineering has been a vibrant discipline, constantly striving to renew itself to meet the challenges of its time. It has undergone two paradigm shifts - the adoption of unit operations starting 1915 and the introduction of chemical reaction engineering and transport phenomena in the early 1960 - and is currently in the midst of a third one. Wherever this third paradigm shift may lead us to, the tradition of interdisciplinarity will remain as the core spirit of chemical engineering. This spirit coupled with its unique position at the interface between molecular sciences (such as biochemistry, chemistry, and molecular biology) and engineering ensures that chemical engineering will continue to have boundless exciting intellectual opportunities for investigation and development of systems, processes, and products of all scales, from nano-, through meso- to mega-, and thus will continue to play a central role in many new and emerging technologies in the future. We are most thankful to all the authors of this Special Issue for their excellent contributions, which come from around the world, mostly from academia, but also from industrial and government research institutions. A number of corresponding authors are internationally renowned leading researchers in their fields. More than a quarter (12) of the 43 participating authors of this Special Issue currently reside in the USA, and the rest work in Taiwan (5), Japan (6), Canada (5) , Korea (5) , Hong Kong (2). Hungary (2). as well as in Azerbaijan, Saudi Arabia, and Thailand (one each). We hope this Special Issue in Chemical Engineering will give the readers from fields other than chemical engineering a number of clear snapshots of research currently ongoing in chemical engineering. For the chemical engineering readers and researchers, we also hope that this Special Issue may lead them to appreciate a little more the benefit of a broad-base multidisciplinary journal, such as Journal of the Chinese Institute of Engineers, as a source for reading and/or for publishing their highly interdisciplinary works.

Derived from text

Chemical Engineering; Thermodynamic Properties; Physical Properties; Oils; Biochemistry

20060005760 Lehigh Univ., Bethlehem, PA, USA

Mathematical Study on Gradient Formation of Cetyltrimethylammonium Bromide in Centrifugal Precipitation Chromatography

Tomanee, Panarat; Sookkumnerd Terasut; Hsu, James T.; Journal of The Chinese Institute of Engineers. Special Issue: Chemical Engineering; Volume 28, No. 7; November 2005, pp. 1053-1060; In English; See also 20060005754; Copyright; Avail.: Other Sources

Centrifugal precipitation chromatography (CPC) is a separation system that mainly employs a moving concentration gradient of precipitating agent along a channel. Solutes of interest undergo repetitive precipitation-dissolution, and fractionate at different locations, and finally elute out from the channel according to their solubility in the precipitant solution. In the practical apparatus, two channels are formed by inserting a piece of dialysis membrane between a pair of disks with mutually mirror-imaged spiral grooves. A sample is injected into one channel and the precipitant solution is fed into another one. When the precipitant travels across the membrane to the sample channel, its concentration gradient is formed. Gradient profile of precipitant inside the sample channel is crucial to the success of CPC; therefore, it is worthwhile to investigate the formation of the precipitant concentration gradient. In this paper, an established mathematical model used to explain the steady-state gradient formation of ammonium sulfate, $(\text{NH}_4)_2\text{SO}_4$, in CPC was adopted for studying the gradient formation of cationic surfactant cetyltrimethylammonium bromide (CTAB). Its concentration, velocity and pressure profile obtained from the model are discussed.

Author

Chromatography; Ammonium Sulfates; Bromides; Gradients; Centrifugal Force; Mathematical Models

20060005762 National Inst. of Advanced Industrial Science and Technology, Tsukuba, Japan

Simulation Study on Ceramic Membrane Reactor for Hydrogen Production

Ohmori, T.; Yu, W.; Yamamoto, T.; Endo, A.; Nakaiwa, M.; Itoh, N.; Journal of The Chinese Institute of Engineers. Special Issue: Chemical Engineering; Volume 28, No. 7; November 2005, pp. 1069-1076; In English; See also 20060005754; Copyright; Avail.: Other Sources

A simulation study was carried out to elucidate the effects of membrane properties in terms of permeability and selective permeability on the design parameters of a porous ceramic membrane reactor for hydrogen production. The reaction involved was methane steam reforming. The design and operating parameters of the membrane reactors associated with four sets of membranes with different permeabilities were determined to achieve both the hydrogen production rate of 1 cu m/h (stp) and the recovery efficiency of 80% at 773 K. It was found that less membrane area was required when a membrane with higher permeability value was used. However, a membrane with a higher selective permeability for hydrogen should be used if the purity of hydrogen is also regarded as one of the process objectives. The sensitivities of the main operating parameters to the reactor performance were also investigated and discussed.

Author

Hydrogen Production; Design Analysis; Ceramics; Membranes; Permeability

20060005763 Ohio State Univ., Columbus, OH, USA

Numerical Study of the Velocity Effects on the Impingement of an Acetone droplet on an High-Temperature Surface

Ge, Yang; Fan, Liang-Shih; Journal of The Chinese Institute of Engineers. Special Issue: Chemical Engineering; Volume 28, No. 7; November 2005, pp. 1077-1087; In English; See also 20060005754; Copyright; Avail.: Other Sources

The process of impact of an acetone droplet upon a hot flat surface is analyzed based on a 3D numerical simulation which considers the evaporation behavior. The 3D level-set method is utilized to track the droplet surface variation during its deformation. The flow field within the droplet and the surrounding gas phase are solved using the finite volume method with the ALE (Arbitrary Lagrangian Eulerian) technique. The dynamic characteristics of the vapor flow are solved by a vapor flow model that accounts for the lubrication resistant effect of the vapor cushion formed by the film-boiling evaporation. The heat flux across the vapor layer and the temperature fields in all phases are determined by using a full field heat transfer model. The effects of the impact velocity are illustrated in this study. The spreading and recoiling motions of the impacting droplets are compared at different impact velocities. As the impact velocity increases, the extent of the droplet spreading increases, but the residence time of the droplet on the surface remains almost unchanged. The heat transfer rate at the solid surface is much larger in the spreading process than that in the recoiling and rebounding processes.

Author

Drops (Liquids); Acetone; Hot Surfaces; Temperature Distribution; High Temperature; Dynamic Characteristics; Evaporation; Finite Volume Method; Flow Distribution

20060005764 Pukyong National Univ., Busan, Korea, Republic of

Sonochemical Degradation of Polycyclic Aromatic Sulfur Hydrocarbons (PASHs) in Aqueous Solutions Exemplified by Benzothiophene

Kim, Il-Kyu; Huang, Chin-Pao; Journal of The Chinese Institute of Engineers. Special Issue: Chemical Engineering; Volume 28, No. 7; November 2005, pp. 1107-1118; In English; See also 20060005754; Copyright; Avail.: Other Sources

The degradation of polycyclic aromatic sulfur hydrocarbons (PASHs) in aqueous solutions due to sonochemical processes was studied. Benzothiophene (BT), and dibenzothiophene (DBT) in addition to two polycyclic aromatic hydrocarbons, namely phenanthrene (Phe) and naphthalene (Nap) were compared. Results showed that all polycyclic aromatic compounds were decomposed rapidly following a pseudo-first-order kinetics upon ultrasonic irradiation in aqueous solutions. The rate constant decreased with increasing pH and decreased with increasing initial benzothiophene concentration. Whereas, for temperature, the rate increased with temperature up to 50 C then decreased upon further increase in temperature above 50 C. Hydroxybenzothiophenes, dihydroxy-benzothiophenes, and benzothiophene-dione were identified as major intermediates. Also evolution of carbon dioxide and sulfite was observed. Hydroxyl radicals play the major role in the decomposition of PASHs. The toxicity of sonochemically treated solutions was evaluated by monitoring the respiration rate of *E. coli*. Results indicate that a sonochemically treated benzothiophene sample improved the respiration rate of *E. coli* compared to an untreated sample.

Author

Sulfur; Polycyclic Aromatic Hydrocarbons; Aqueous Solutions; Degradation; Reaction Kinetics

20060005765 Azerbaijan State Oil Academy, Baku, Azerbaijan

Vapor Pressures and Derived Thermodynamic Properties of Aqueous Zn(NO₃)(sub 2) Solutions from 423.15 to 623.15 K

Azizov, Nazim Djait; Journal of The Chinese Institute of Engineers. Special Issue: Chemical Engineering; Volume 28, No. 7; November 2005, pp. 1119-1125; In English; See also 20060005754; Copyright; Avail.: Other Sources

Vapor pressures of aqueous Zn(NO₃)₂ solutions (0.321, 0.499, 0.900, 1.400, 2.000, and 3.002 mol/kg) have been measured by the static method in the temperature range from 423.15 to 623.15 K with a constant-volume piezometer immersed in a precision liquid thermostat. The total uncertainty of temperature, pressure, and composition measurements were estimated to be less than 15 mK, 0.2%, and 0.014%, respectively. The vapor pressures of pure water were measured to confirm the accuracy of the method for aqueous Zn(NO₃)₂ solutions taken using the apparatus and procedure in this study. The resulting measurements of P(sub s) - T(sub s) for pure water were compared with values calculated from IAPWS formulation. Useful thermodynamic functions (water and electrolyte activities, osmotic coefficient, excess relative partial molar entropy, and relative partial molar enthalpy values of solvent) were derived using measured values of vapor pressure for the solutions and pure water.

Author

Vapor Pressure; Thermodynamic Properties; Aqueous Solutions; Zinc Compounds; Electrolytes; Entropy; Temperature Measurement; Pressure Measurement

20060006331 National Inst. of Standards and Technology, Gaithersburg, MD USA

Dispersed Liquid Agent Fire Suppression Screen. Final Technical Report

Yang, J. C.; Donnelly, M. K.; Prive, N.; Grosshandler, W. L.; Mar. 31, 2000; 52 pp.; In English
Report No.(s): PB2006-104521; No Copyright; Avail.: CASI: [A04](#), Hardcopy

The performances of the burner and the flow facility have also been extensively characterized by examining various operational parameters. Day-to day and burner variations also did not affect critical blow-off limits. The facility is not difficult to operate. For generation of liquid droplets, a commercially available ICP (Inductively Coupled Plasma) nebulizer, in lieu of a piezoelectric droplet generator, is better suited for screening liquid agents with high loading of dissolved salt. Clogging of orifice opening in the piezoelectric droplet generator becomes unavoidable when fluids with dissolved salts are used due to salt-out effects at the small orifice opening. The application of an ICP nebulizer alleviates the clogging problems because the opening of the capillary is larger; however, the spray generated is polydispersed. The performance of the nebulizer does not change significantly when fluids with different thermophysical properties are used within the range of conditions encountered in the screening procedure. The nebulizer coupled with a small syringe pump can be used to perform screening tests with small quantities (approx. 10 ml or less) of liquid agents.

NTIS

Drops (Liquids); Fire Extinguishers; Fires; Spraying

20060006371 Department of Energy, Washington, DC, USA

Solutia: Massachusetts Chemical Manufacturer Uses SECURE Methodology to Identify Potential Reductions in Utility and Process Energy Consumption

January 2005; 8 pp.; In English

Report No.(s): DE2005-15016578; No Copyright; Avail.: Department of Energy Information Bridge

Solutia Inc. recently completed a plant-wide energy assessment at its chemical production facility in Springfield, Massachusetts; the assessment team focused on finding ways to reduce the site-wide use of steam, electricity, compressed air, and water. The assessment treated the facility as a single entity, addressing energy and cost conservation opportunities in both supply-side (utility) systems and demand-side (production) processes. Solutia's energy management team conducted the assessment to help ensure that process designs maximize energy conservation while minimizing waste generation. If all projects identified during the study were implemented, the total estimated annual energy savings would be about 9.6 million kWh in electricity and more than 338,000 MMBtu in natural gas. At an investment of \$6.3 million, total annual cost savings were estimated to be nearly \$3.3 million.

NTIS

Chemical Engineering; Energy Consumption; Industries

20060006373 Lawrence Livermore National Lab., Livermore, CA USA

Interface Documentation for MS Material Models

Becker, R.; May 11, 2005; 14 pp.; In English

Report No.(s): DE2005-15016509; UCRL-SM-212168; No Copyright; Avail.: Department of Energy Information Bridge

The interface for the MS material model has been modified to utilize results from EOS calculations performed in the host code. This is thought to be feasible for the following models: All of the hardening models associated with the traditional von Mises yield surface (J2-Flow theory) including most of the loosely coupled fractured models. This includes the Moss-Attia-Rubin (marfract) model. Simple anisotropic materials, but this may prove to be more general. The Gurson model with the assumption that the bulk modulus is constant over the range of pressures at which voids can exist. This is not a bad assumption considering that voids vanish at high pressure. Crystal plasticity for cubic crystal structures and possibly others with sufficient approximations.

NTIS

Mathematical Models; Materials

24

COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

20060005680 Forest Products Lab., Madison, WI USA

Two-Year Wisconsin Thermal Loads for Roof Assemblies and Wood, Wood Plastic Composite, and Fiberglass Shingles

Winandy, J. E.; Grambsch, M.; Hatfield, C. A.; Nov. 2005; 20 pp.; In English

Report No.(s): PB2006-101580; FPL-RN-0301; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Temperature histories for various types of roof shingles, wood roof sheathing, roof rafters, and non-ventilated attics are being monitored in outdoor attic structures using simulated North American light-framed construction. This report presents 2-year data histories for annual thermal loads for western red cedar, wood-thermoplastic composite, and fiberglass shingles and for wood-based composite roof sheathing, wood rafters, and attics under these shingles.

NTIS

Composite Materials; Glass Fibers; Loads (Forces); Roofs; Wood

20060005720 Forest Products Lab., Madison, WI USA

Comparison of Block Shear Methods for Determining Shearing Strength of Solid Wood

Feb. 1964; 30 pp.; In English

Report No.(s): PB2006-102797; FPL-030; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Information concerning the relative magnitudes of shear strength as determined by using cube-shaped or notched specimens in roller or nonroller testing apparatus has often been contradictory. This document describes a comparative study, conducted at the U.S. Forest Products Laboratory and the Australian C.S.I.R.O. Division of Forest Products on six different

specimen-apparatus combinations using matched specimens of southern yellow pine and overcup oak.

NTIS

Shearing; Wood

20060005748 Kentucky Univ., Lexington, KY USA

Shear Repair of P/C Box Beams Using Carbon Fiber Reinforced Polymer (CFRP) Fabric

Simpson, J. W.; Harik, I. E.; Chiaw, C. C.; Jan. 2006; 46 pp.; In English

Report No.(s): PB2006-101651; DTC-06-01/FRT114-01-1F; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The report documents the retrofit work carried out on the KY3297 Bridge over Little Sandy River in Carter County, Kentucky. Field investigation and evaluation revealed that the bridge superstructure was deficient in shear. The repair work was carried out using externally bonded carbon fiber reinforced polymer (CFRP) fabric system. The repair, using externally bonded fiber system, offers the following benefits: (1) the use of light construction equipment, hand kits and tools, (2) minimal traffic disruption as all lanes were open to traffic while work was being performed underneath the bridge, and (3) cost saving; the cost for the repair and 3-years monitoring was USD \$105,000.00 compared to the estimated superstructure replacement cost of USD \$600,000.00.

NTIS

Box Beams; Carbon Fiber Reinforced Plastics; Carbon Fibers; Composite Materials; Concretes; Fabrics; Fiber Composites; Shear Strength

25

INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

Includes the analysis, synthesis, and use of inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see category *34 Fluid Dynamics and Thermodynamics*. For astrochemistry see category *90 Astrophysics*.

20060005598 Royal Netherlands Meteorological Inst., Netherlands

Practical evaluation of the performance of the Handheld Automatic Chemical Alarm Detector System A (ACADS System A) for the detection of eight Toxic Industrial Chemicals (TICS)

Oliver, R. C. M.; Hartevelde, J. L. N.; Zappey, H. W.; October 2005; 35 pp.; In English; Original contains color and black and white illustrations

Report No.(s): TNO-DV2 2005 A081; Copyright; Avail.: Other Sources

Description of the results of a practical evaluation of the selected ACADS System A detector, ChemPro100, for the vapour detection of eight selected toxic industrial chemicals. The goal of the laboratory testing and evaluation project was confirmation of the compliance of ChemPro100 to the specific TIC detection requirements. The assessment of the sensitivity evaluation factors such as detection limit and response time is based on the Immediate Danger to Life and Health Level (IDLH) versus the detection range of the detector. This to confirm whether or not the detector would be capable of detecting and warn for the presence of the selected TICs at the required IDLH level.

Author

Toxicity; Warning Systems; Automatic Control; Chemicals; Gas Detectors

20060005688 Transportation Security Administration, Washington, DC, USA

Final Report for Vapor Pressure Study of Explosives and Related Compounds

Gongwer, P. E.; Sep. 2003; 24 pp.; In English

Report No.(s): PB2006-101631; DHS/TSA/TSL-05/37; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This is the final report for a program to assemble an easily used, critically reviewed database of vapor pressures over explosives. The compounds that were considered in this work included selected actual explosives, and also associated manufacturing and processing compounds, taggants, and decomposition products. Observations on the effect of mixtures on the vapor pressures of the pure components were also investigated. Recommendations were made for additional data needs and for experiments to supply these data. The Phase I database will be submitted as a separate document.

NTIS

Explosives; Explosives Detection; Vapor Pressure

20060005746 Gas Technology Inst., Des Plaines, IL, USA, Nanoscale Materials, Inc., Manhattan, KS, USA
Development and Evaluation of Nanoscale Sorbents for Mercury Capture from Warm Fuel Gas
Jadhav, R. A.; Meyer, H.; Oct. 2005; 16 pp.; In English
Report No.(s): DE2005-859240; No Copyright; Avail.: National Technical Information Service (NTIS)

Several nanocrystalline sorbents were evaluated for their mercury-sorption capacity in GTI's mercury-sorbent testing facility. These preliminary tests were carried out in mercury-laden N₂ stream at 423 and 533 K. Desorption tests on the post-sorbed sorbents were carried out to understand the mechanism of interaction between mercury and the sorbent. Of the eight nanocrystalline sorbents evaluated, NanoActive Cr(sub 2)O(su 3) was the most effective sorbent at both 423 and 533 K. NanoActive MnO(sub 2) and CuO sorbents also showed promise for capture of mercury from N₂ stream. Desorption tests indicated that the capture of mercury took place by a combination of physical and chemical adsorption. It is speculated that the NanoActive metal oxides oxidized mercury to HgO form that was immobilized on the sorbent surface. Presulfidation of NanoActive CuO increased its Hg-sorption capacity at 423 K; however, presulfided NanoActive MnO(sub 2) sorbent became ineffective for Hg capture at both 423 and 533 K.

NTIS

Sorbents; Sorption; Copper Oxides; Metal Oxides

20060006332 National Inst. for Occupational Safety and Health, Washington, DC, USA
In Vitro Mordenite Fiber Dissolution at Acidic pH
Stephenson, D.; Hoover, M. D.; Sep. 2005; 28 pp.; In English
Contract(s)/Grant(s): R03-OH07378-02

Report No.(s): PB2006-103436; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Mordenite is an aluminosilicate zeolite mineral similar to asbestos. The unique structural and chemical properties make mordenite favorable to a wide variety of commercial applications ranging from waste-effluent treatment to paper production. Interest in mordenite, as an occupational inhalation hazard, arose when it was discovered that the fibrous form of the mineral exists in the subsurface of Yucca Mountain, NY, the site of a federally proposed nuclear waste repository. During preliminary geologic investigations at Yucca Mountain, workers performing dry-drilling operations were potentially being exposed to aerosols of mordenite. In addition, environmental exposures to zeolites (including mordenite) were brought to the world's attention when a reported outbreak of mesothelioma was documented in the Cappadocia region of Turkey.

NTIS

Acidity; Dissolving; Hazards; In Vitro Methods and Tests; pH

26

METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

20060005581 Royal Netherlands Meteorological Inst., Netherlands

Bullet Impact and Fragment Impact: Preliminary Research

Meuken, B.; Scholtes, J. H. G.; October 2005; 27 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

For decades fragment impact experiments are carried out by a number of countries in different experimental set-up. The NIMIC report shows a very thorough and detailed summary of the different bullet/fragment test methods, and is therefore summarized here. This literature review also summarizes modeling approaches on bullet impact, XDT, shaped charge jet initiation, and more general shear as damage mechanisms in explosive materials. Finally the types of damage and the effects of damage (thermal and physical) on the sensitivity of the explosive are discussed.

Author

Fragments; Projectiles; Shaped Charges; Damage

20060005767 National Central Univ., Chung-Li, Taiwan, Province of China

Zirconia-Coated Lithium Cobalt Oxide as a Long-Cycling Cathode for Lithium Batteries

Fey, George Ting-Kyo; Huang, Jiun-Da; Kumar, T. Prem; Chang, Yu-Chen; Journal of The Chinese Institute of Engineers. Special Issue: Chemical Engineering; Volume 28, No. 7; November 2005, pp. 1139-1151; In English; See also 20060005754
Contract(s)/Grant(s): NSC-91-2622-E-008-006-CC3; Copyright; Avail.: Other Sources

A commercial sample of LiCoO₂ was coated with ZrO₂ by sol-gel and mechano-thermal processes. The effects of the

coating method and the precursor used in the sol-gel coating process were studied. Electron microscopic images of the coated particles revealed the presence of a compact coating over the cathode particles. XRD and ESCA results suggested the formation of substitutional compounds of the composition $\text{Li}(x) \text{Zr}(y) \text{Co}(1-y)\text{O}(2 + 0,5y)$ on the surface of the cathode. Coating levels of 0.3 and 1.0 wt.% were found to be optimal in terms of cyclability for the materials coated by the sol-gel and mechano-thermal methods, respectively. At these coating levels, the R-factor values, determined from XRD data, were the lowest. The maximum improvements in cyclability registered at a 0.2 C rate were about eight-fold with the sol-gel and mechano-thermal coating methods. Cyclic voltammetric studies showed that the coating led to a suppression of the cycle-limiting phase transitions accompanying the charge-discharge processes.

Author

Zirconium Oxides; Coating; Lithium Oxides; Cobalt Oxides; Cathodes

27

NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see *24 Composite Materials*.

20060005603 Royal Netherlands Meteorological Inst., Netherlands

The Behavior of Liquid on Clothing

Brasser, P.; November 2005; 54 pp.; In English; Original contains color illustrations

Report No.(s): TD2005; Copyright; Avail.: Other Sources

In view of the project '517B Validatie Modellen NBC kleding' of the VO13 program, measurements of drops on textile were performed. Furthermore, models, which describe the relevant physical processes are proposed. In this report contact angle measurements of liquids on various types of textile as a function of time are discussed. The rate of change of the liquid volume of the drop is analysed as a function of time. Modellen are derived, which describe the spreading, the penetration and the evaporation of the drop as a function of time. The results of the measurements were compared to the model results. The results of the evaporation model agree quite well with the experimental results. The proposed penetration models are less adequate.

Author

Clothing; Drops (Liquids); Penetration; Textiles; Time Dependence

20060005766 National Central Univ., Chung-Li, Taiwan, Province of China

Solubility of Ethylene in Toluene and Norbornene Mixture at Various Temperatures and Pressures

Lee, Liang-Sun; Ou, Hsin-Jung; Shih, Ruey-Fu; Lee, Tien-San; Journal of The Chinese Institute of Engineers. Special Issue: Chemical Engineering; Volume 28, No. 7; November 2005, pp. 1127-1138; In English; See also 20060005754; Copyright; Avail.: Other Sources

Cyclic olefin copolymer (COC) is a newly developed high quality ethylene-norbornene engineering plastic product. This COC is produced by the reaction of attaching an ethyl group to the norbornene monomer in the liquid phase. The production process of COC is dependent on the solubility of ethylene in a liquid mixture of norbornene, toluene (solvent for this process), and the product COC. In order to find better conditions for generating COC, a better understanding about the phase behavior of this mixture is very useful. In this study, the solubilities of ethylene in a mixture of toluene and norbornene were measured in temperatures ranging from 323.15 to 423.15 K, a pressure range from 5 to 25 bar, and norbornene concentration from 0 to 85wt%. The experiments were conducted with a newly designed apparatus by the pressure decaying method. The experimental results show that the solubility of ethylene in toluene and norbornene mixture increases with system pressure but decreases with system temperature. Ethylene will dissolve more in toluene + norbornene mixture than in the pure toluene, as in our earlier report. The experimental solubility data were expressed in the vapor-liquid equilibrium relationship and correlated fairly well with the bubble pressure calculation using the Peng-Robinson equation of state (PR EOS) incorporated with the van der Waals one-fluid (vdW 1) and the Zhong-Masuoka (Z-M) mixing rules and with the consideration of binary interaction parameters. The largest average absolute deviation percentage of correlation of this ternary system is 3.09% for pressure at 323.15 K.

Author

Solubility; Ethylene; Toluene; Liquid-Vapor Equilibrium; Copolymers

20060006335 Texas Univ., Austin, TX, USA

Repair of Galvanizing After UIT Application

Frank, K. H.; Palmatier, A. H.; Jun. 2005; 26 pp.; In English

Report No.(s): PB2006-103427; Copyright; Avail.: National Technical Information Service (NTIS)

Ultrasonic Impact Treatment (UIT) to the weld toe of a galvanized mast arm removes the galvanizing in the treated area. UIT is applied to increase the fatigue performance of the mast arm by introducing compressive residual stresses at the treated weld toes and reshaping the intersection of the weld toe and the arm to reduce the local stress concentration. In order to prevent corrosion at the treated area, the weld toe must be recoated. There are various methods that can be employed to repair the treated area. The first method of repair is the application of zinc rich paint. Previous test results show that mast arms treated with a zinc rich paint after UIT application behave the same in fatigue as mast arms with UIT application without coating. The second method of repair is regalvanizing the treated arm in a hot-dip galvanizing bath. Previous tests show that hot-dip galvanizing after UIT application removes the benefit of UIT. A third method of repair uses a zinc-lead solder. The zinc-lead solder is applied to a heated surface at a working temperature of 600 degrees F to 750 degrees F, at which point the solder melts upon solidification repairs the galvanized coating.

NTIS

Beams (Supports); Traffic; Ultrasonic Processing; Zinc Coatings

20060006425 Bureau of the Census, Washington, DC, USA

Economic Census 2002: Mining, Industry Series. Clay and Ceramic and Refractory Minerals Mining

Dec. 2004; 44 pp.; In English

Report No.(s): PB2006-103084; EC02-21I-212325(RV); No Copyright; Avail.: CASI: [A03](#), Hardcopy

The economic census is the major source of facts about the structure and functioning of the nation's economy. It provides essential information for government, business, industry, and the general public. Title 13 of the USA Code (Sections 131, 191, and 224) directs the Census Bureau to take the economic census every 5 years, covering years ending in 2 and 7. The economic census furnishes an important part of the framework for such composite measures as the gross domestic product estimates, input/output measures, production and price indexes, and other statistical series that measure short-term changes in economic conditions. The Mining sector comprises establishments that extract naturally occurring mineral solids, such as coal and ores; liquid minerals, such as crude petroleum; and gases, such as natural gas. The term mining is used in the broad sense to include quarrying, well operations, beneficiating (e.g., crushing, screening, washing, and flotation), and other preparation customarily performed at the mine site, or as a part of mining activity.

NTIS

Census; Ceramics; Clays; Economic Analysis; Economics; Industries; Minerals; Mining; Refractories

28

PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power*; *20 Spacecraft Propulsion and Power*; and *44 Energy Production and Conversion*.

20060005844

Validation and Enhancement of Comprehensive Combustion Modeling and Simulation

October 2005; 34 pp.

Contract(s)/Grant(s): NCC3-925; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The three-dimensional, viscous, turbulent, reacting and non-reacting flow characteristics of a model gas turbine combustor operating on air/methane are simulated via an unstructured and massively parallel Reynolds-Averaged Navier-Stokes (RANS) code. This serves to demonstrate the capabilities of the code for design and analysis of real combustor engines. The effects of some design features of combustors are examined. In addition, the computed results are validated against experimental data. The numerical model encompasses the whole experimental flow passage, including the flow development sections for the air annulus and the fuel pipe, twelve channel air and fuel swirlers, the combustion chamber, and the tail pipe. A cubic non-linear low-Reynolds number K- ϵ turbulence model is used to model turbulence, whereas the eddy-breakup model of Magnussen and Hjertager is used to account for the turbulence combustion interaction. Several RANS calculations are performed to determine the effects of the geometrical features of the combustor, and of the grid resolution on the flow field. The final grid is an all-hexahedron grid containing approximately two and one half million elements. To provide an inlet condition to the main

combustion chamber, consistent with the experimental data, flow swirlers are adjusted along the flow delivery inlet passage. Fine details of the complex flow structure such as helical-ring vortices, recirculation zones and vortex cores are well captured by the simulation. Consistent with the experimental results, the computational model predicts a major recirculation zone in the central region immediately downstream of the fuel nozzle, a second recirculation zone in the upstream corner of the combustion chamber, and a lifted flame. Further, the computed results predict the experimental data with reasonable accuracy for both the cold flow and for the reacting flow. It is also shown that small changes to the geometry can have noticeable effects on the combustor flowfield.

Author

Combustion Chemistry; Mathematical Models; Fuel Combustion; Simulation

32

COMMUNICATIONS AND RADAR

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and 17 *Space Communications, Spacecraft Communications, Command and Tracking*; for search and rescue, see 03 *Air Transportation and Safety*; and 16 *Space Transportation and Safety*.

20060005677 Newcastle-upon-Tyne Univ., Newcastle, UK

Rules-Based SSDL Protocol Framework

Kuo, D.; Greenfield, P.; Parastatidis, S.; Webber, J.; Apr. 2005; 20 pp.; In English

Report No.(s): PB2006-102748; CS-TR-902; Copyright; Avail.: National Technical Information Service (NTIS)

The Rules-based SSDL Protocol Framework defines a collection of XML Infoset element information items that can be used to describe the messaging behaviour of a service. The framework use conditions (Boolean expressions) to precisely specify when messages can be sent and received by a service. A distributed applications application protocol is defined by the messaging behaviour of interacting services participating in the distributed application.

NTIS

Data Bases; Protocol (Computers); Soaps

20060005694 Government Accountability Office, Washington, DC, USA

Internet Management: Prevalence of False Contact Information for Registered Domain Names

Nov. 2005; 56 pp.; In English

Report No.(s): PB2006-103474; GAO-06-165; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Individuals or organizations seeking to register the names of their Web sites may provide inaccurate contact information to registrars in order to hide their identities or to prevent members of the public from contacting them. Contact information is made publicly available on the Internet through a service known as Whois. Data accuracy in the Whois service can help law enforcement officials to investigate intellectual property misuse and online fraud, or identify the source of spam e-mail, and can help Internet operators to resolve technical network issues. GAO was asked, among other things, to (1) determine the prevalence of patently false or incomplete contact data in the Whois service for the .com, .org, and .net domains; (2) determine the extent to which patently false data are corrected within 1 month of being reported to ICANN; and (3) describe steps the Department of Commerce (Commerce) and ICANN have taken to ensure the accuracy of contact data in the Whois database.

NTIS

Computer Networks; Internets; Websites

20060005710 Bureau of the Census, Washington, DC, USA

Economic Census 2002: Construction, Industry Series. Power and Communication Line and Related Structures Construction

Dec. 2004; 50 pp.; In English

Report No.(s): PB2006-103095; EC02-23I-237130; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The economic census is the major source of facts about the structure and functioning of the nation's economy. It provides essential information for government, business, industry, and the general public. Title 13 of the USA Code (Sections 131, 191, and 224) directs the Census Bureau to take the economic census every 5 years, covering years ending in '2' and '7'. The economic census furnishes an important part of the framework for such composite measures as the gross domestic product

estimates, input/output measures, production and price indexes, and other statistical series that measure short-term changes in economic conditions.

NTIS

Census; Classifications; Communication Cables; Construction; Construction Industry; Economic Analysis

20060005756 Ottawa Univ., Ontario, Canada

Liebermann-Fried Model Parameters for Calculating Vapour-Liquid Equilibria of Oxygenate and Hydrocarbon Mixtures

Wang, Zhaohui; Lu, Benjamin C.-Y.; Peng, Ding-Yu; Lan, Christopher Q.; Journal of The Chinese Institute of Engineers. Special Issue: Chemical Engineering; Volume 28, No. 7; November 2005, pp. 1089-1105; In English; See also 20060005754; Copyright; Avail.: Other Sources

The Liebermann-Fried model parameters are reported for a total of 123 binary non-associated mixtures, covering ten oxygenates and 16 hydrocarbons. They were determined from excess enthalpies of binary mixtures available in the literature at 298.15 K. It is feasible to use these parameters for obtaining reasonably reliable vapour-liquid equilibria at constant temperature or at constant pressure for mixtures containing the considered binary mixtures.

Author

Liquid-Vapor Equilibrium; Computation; Binary Mixtures

33

ELECTRONICS AND ELECTRICAL ENGINEERING

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment; and microelectronics and integrated circuitry. for related information see also *60 Computer Operations and Hardware*; and *76 Solid-State Physics*. For communications equipment and devices see *32 Communications and Radar*.

20060005670 Princeton Resources, Inc., NJ, USA, Colorado State Univ., Fort Collins, CO, USA

Integrated Ferroelectrics Journal, Volume 70 (2005)

Taylor, G. W.; Paz De Araujo, C. A.; January 2005; 178 pp.; In English

Report No.(s): PB2006-101624; Copyright; Avail.: National Technical Information Service (NTIS)

Contents: Electrical Properties of BST Thin Films Fabricated By A Modified Sol-Gel Processing; Effect of the Coating Speed On Dipole Relaxation Time In The YMnO_3 Thin Films; Sol-Gel Processing Of Lead Lanthanum Zirconate Titanate Fibers; Scaling the Ferroelectric Field Effect Transistor; Effect of Zr Substitution for Ti on the Dielectric and Ferroelectric Properties of Barium Titanate Thin Films.

NTIS

Ferroelectricity; Fabrication

20060005678 Princeton Resources, Inc., NJ, USA, Colorado State Univ., Fort Collins, CO, USA

Proceedings of the International Symposium on Ferroelectricity and Piezoelectricity IMRC 2004. Volume 71 (2005). Held in Cancun Mexico on August 22-26, 2004

Taylor, G. W.; Paz De Araujo, C. A.; January 2005; 336 pp.; In English; International Symposium on Ferroelectricity and Piezoelectricity IMRC 2004. Volume 71 (2005)., August 22 - 26, 2004, Cancun Mexico

Report No.(s): PB2006-101625; Copyright; Avail.: National Technical Information Service (NTIS)

Partial Contents: Organizing Committee and Sponsors Guest Editorial; Dielectric Permittivity and Pyroelectric Response of Compositionally Graded Ferroelectrics; Comparative Studies of Ferroelectric Thin Films for High Frequency Phase Shifter Applications; In Situ Measurements of Macroscopic Film Stress During Growth, Cooling, And Thermal Cycling Of Thin Film PbTiO_3 ; Thin Film Processing and Integration Methods to Enable Affordable Mobile Communications Systems; Ferromagnetic-Ferroelectric Layered Structures: Magnetoelectric Interactions and Devices; Oriented Ferroelectric Thin Films on Soluble Substrates; Strong Degradation of Physical Properties and Formation of a Dead Layer In Ferroelectric Films Due to Interfacial Dislocations.

NTIS

Conferences; Ferroelectricity; Piezoelectricity

20060005715 Forest Products Lab., Madison, WI USA

Calibration of Electric Moisture Meters for Some Wood Species Grown in Hawaii

Oct. 1964; 32 pp.; In English

Report No.(s): PB2006-102802; FPL-061; No Copyright; Avail.: CASI: [A03](#), Hardcopy

This Research Note presents species correction data for use with electric moisture meters in measuring the moisture content of five wood species grown in Hawaii, namely: saligna and robusta eucalyptus (*Eucalyptus saligna* and *Eucalyptus robusta*), silk-oak (*Grevillea robusta*), ohia (*Metrosideros collina*), and koa (*Acacia koa*). Indexes of direct current electrical resistance and radio frequency power absorption were obtained at a temperature of 80DG F. and at moisture content values ranging from about 6 percent to above the fiber saturation point for each species. The data were obtained using commercial moisture meters of both the resistance and radio frequency power-loss types. True moisture content was defined as that obtained by the oven-drying method.

NTIS

Calibrating; Moisture Meters; Wood

20060006333 ARCADIS Geraghty and Miller, Inc., Durham, NC, USA

Evaluation of Fugitive Emissions at a Former Landfill Site in Colorado Springs, Colorado Using Ground-Based Optical Remote Sensing Technology

Modrak, M.; Hashmonay, R. A.; Varma, R.; Kagann, R.; Apr. 2005; 54 pp.; In English

Report No.(s): PB2006-103429; No Copyright; Avail.: CASI: [A04](#), Hardcopy

A former landfill site located in Colorado Springs, Colorado was assessed for landfill gas emissions in support of reuse options for the property. The current owners of the landfill and the State of Colorado requested assistance from the EPA Region 8 Office, and the Office of Superfund Remediation and Technology Innovation, Technology Integration and Information Branch to perform a site assessment to search for the presence of any fugitive gas emissions from the site. The focus of this study was to evaluate fugitive emissions of methane and volatile organic compounds at the site in support of the reuse objectives, using a scanning open-path Fourier transform infrared spectrometer, open-path tunable diode laser absorption spectroscopy, and an ultra-violet differential optical absorption spectrometer. The study involved a technique developed through research funded by the EPA's National Risk Management Research Laboratory that uses ground-based optical remote sensing technology, known as optical remote sensing-radial plume mapping. The horizontal radial plume mapping (HRPM) method was used to map surface concentrations, and the Vertical Radial Plume Mapping (VRPM) method was used to measure emissions fluxes downwind of the site.

NTIS

Colorado; Landfills; Remote Sensing

34

FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics*.

20060005755 Saskatchewan Univ., Saskatoon, Saskatchewan, Canada

An Equation of State for Associating Systems

Peng, Ding-Yu; Pang, Jianyuan; Lu, Benjamin C.-Y.; Journal of The Chinese Institute of Engineers. Special Issue: Chemical Engineering; Volume 28, No. 7; November 2005, pp. 1157-1168; In English; See also 20060005754; Copyright; Avail.:

Other Sources

The thermodynamic framework proposed by Hu et al. (1984) for generating the Helmholtz free energy functions for associating systems is rectified. A generic cubic equation of state is incorporated with the infinite linear association model and the monomer-dimer association model as well as two different sets of mixing rules to result in four different forms of equations of state. The Peng-Robinson equation of state is accordingly reformulated and the applicability of one of the reformulated equations is tested by using the selected equation to correlate the vapor pressures and liquid densities of water and selected alcohols. The values calculated by means of the reformulated Peng-Robinson equation are in good agreement with the experimental data reported in the literature. Key Words: associating system, mixing rules, Helmholtz free energy, Peng-Robinson equation.

Author

Equations of State; Free Energy; Vapor Pressure

STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structures. For applications see *05 Aircraft Design, Testing and Performance*; and *18 Spacecraft Design, Testing and Performance*.

20060006410 Lawrence Livermore National Lab., Livermore, CA USA

Simulation of an Extensive Underground Structure Subjected to Dynamic Loading Using the Distinct Element Method

Morris, J. P.; Bonner, M. P.; Nov. 16, 2004; 14 pp.; In English

Report No.(s): DE2005-15016842; UCRL-CONF-208024; No Copyright; Avail.: Department of Energy Information Bridge

We present results from an investigation into the stability of underground structures in response to explosive loading. Field tests indicate that structural response can be dominated by the effect of preexisting fractures and faults in the rock mass. Consequently, accurate models of underground structures must take into account deformations across fractures and not simply within the intact portions of the rock mass. The distinct element method (DEM) is naturally suited to simulating such systems because it can explicitly accommodate the blocky nature of natural rock masses. We will discuss details specific to our implementation of the DEM and summarize recent results.

NTIS

Computerized Simulation; Dynamic Loads; Simulation; Underground Structures

ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power*; *20 Spacecraft Propulsion and Power*; and *28 Propellants and Fuels*.

20060005728 National Renewable Energy Lab., Golden, CO USA

EFG Technology and Diagnostic R&D for Large-Scale PV Manufacturing. Final Subcontract, March 1, 2002-March 31, 2005

Kalejs, J.; Aurora, P.; Bathey, B.; Cao, J.; Doedderlein, J.; Oct. 2005; 36 pp.; In English

Report No.(s): DE2005-15020504; NREL/SR-520-38680; No Copyright; Avail.: National Technical Information Service (NTIS)

The objective of this subcontract was to carry out R&D to advance the technology, processes, and performance of RWE Schott-Solar's wafer, cell, and module manufacturing lines, and help configure these lines for scaling up of edge-defined, film-fed growth (EFG) ribbon technology to the 50-100 MW PV factory level. EFG ribbon manufacturing continued to expand during this subcontract period and now has reached a capacity of 40 MW. EFG wafer products were diversified over this time period. In addition to 10 cm x 10 cm and 10 cm x 15 cm wafer areas, which were the standard products at the beginning of this program, R&D has focused on new EFG technology to extend production to 12.5 cm x 12.5 cm EFG wafers. Cell and module production also has continued to expand in Billerica. A new 12-MW cell line was installed and brought on line in 2003. R&D on this subcontract improved cell yield and throughput, and optimized the cell performance, with special emphasis on work to speed up wafer transfer, hence enhancing throughput. Improvements of wafer transfer processes during this program have raised cell line capacity from 12 MW to over 18 MW. Optimization of module manufacturing processes was carried out on new equipment installed during a manufacturing upgrade in Billerica to a 12-MW capacity to improve yield and reliability of products.

NTIS

Manufacturing; Photovoltaic Conversion

20060005736 National Renewable Energy Lab., Golden, CO USA, Evergreen Solar, Inc., Marlboro, MA, USA

Innovative Approaches to Low-Cost Module Manufacturing of String Ribbon Si PV Modules

Hanoka, J. I.; Brown, K.; Oct. 2005; 56 pp.; In English

Report No.(s): DE2005-15020503; NREL/SR-520-38679; No Copyright; Avail.: National Technical Information Service (NTIS)

A three year PV Manufacturing Research and Development subcontract has resulted in major gains for Evergreen Solar. As a result of this work, Evergreen is now poised to take String Ribbon technology to new heights. In the ribbon growth area,

project Gemini - the growth of dual ribbons from a single crucible-has reached or exceeded all the manufacturing goals set for it. This project grew from an R&D concept to a production pilot phase and finally to a full production phase, all within the span of this subcontract. A major aspect of the overall effort was the introduction of controls and instrumentation as in-line diagnostic tools. In the ribbon production area, the result has been a 12% increase in yields, a 10% increase in machine uptime, and the flattest ribbon ever grown at Evergreen. In the cell area, advances in process development and robotic handling of Gemini wafers have contributed, along with the advances in crystal growth, to a yield improvement of 6%. Particularly noteworthy in the cell area was the refinement of the no-etch process whereby the as-grown ribbon surface could be controlled sufficiently to allow this process to succeed as well as it has. This process obviates any need for wet chemistry or etching between ribbon growth and diffusion. Evergreen's factory in Marlboro, MA, has expanded to a maximal capacity of about 15 MW/yr. The net result of all of this has been a reduction of 33% in direct manufacturing costs, a very notable achievement. Earlier in the project, the focus was on monolithic module development. With the Gemini advances described above, the focus of the entire project changed and the monolithic module work was brought to a close during this second year of the overall three year project. A significant advance in this technology was the development of a conductive adhesive in combination with Evergreen's proprietary backskin and encapsulant. 25 W size experimental monolithic modules have been tested and found to be able to withstand up to 1600 thermal cycles.

NTIS

Low Cost; Manufacturing; Modules; Photovoltaic Cells; Ribbons; Solar Cells; Strings

20060005737 National Renewable Energy Lab., Golden, CO USA, Astrosystems International, Inc., Newark, DE, USA
High Volume Manufacturing of Silicon-Film Solar Cells and Modules. Final Subcontract Report, February 26, 2003-September 30, 2003

Rand, J. A.; Culik, J. S.; Oct. 2005; 48 pp.; In English

Report No.(s): DE2005-15020502; NREL/SR-520-38677; No Copyright; Avail.: National Technical Information Service (NTIS)

The objective of the PV Manufacturing R&D subcontract was to continue to improve AstroPower's technology for manufacturing Silicon-Film wafers, solar cells, and modules to reduce costs, and increase production yield, throughput, and capacity. As part of the effort, new technology such as the continuous back metallization screen-printing system and the laser scribing system were developed and implemented. Existing processes, such as the silicon nitride antireflection coating system and the fire-through process were optimized. Improvements were made to the statistical process control (SPC) systems of the major manufacturing processes: feedstock preparation, wafer growth, surface etch, diffusion, and the anti-reflection coating process. These process improvements and improved process control have led to an increase of 5% relative power, and nearly 15% relative improvement in mechanical and visual yield. Significant progress was made in reducing the amount of silicon consumed by the Silicon-Film process. The introduction of a near net shape wafer formation process has reduced the amount of silicon feedstock used per wafer by 40% and other developments in the feedstock preparation and wafer growth processes promise to further reduce the amount of silicon used per wafer by an additional 15%. The Silicon-Film process has consistently demonstrated a high tolerance to impurities. Work has been done to understand the impact of impurities on device and growth performance. Experimentation has focused on tuning the growth parameters and optimizing getter sequences to reduce the detrimental effects of these impurities. To take advantage of Silicon-Film's high tolerance to impurities, efforts were made to upgrade metallurgical-grade (MG) silicon to a purity level needed for the Silicon-Film process through the continuous uni-directional solidification (CUDS) process. Under the PV Manufacturing R&D subcontract a new large area module lamination manufacturing line with a new large area module tester was designed to accommodate the APx-140 modules. In order to reduce module defects, a more rigorous pre-lamination inspection system equipped with an IR inspection station was implemented and improvements in the module design have focused on reducing series resistance losses by increasing the cross-sectional area of the tabbing. On the system level AstroPower has developed a new method to mount large area APx-140 modules, which promises to be lower cost and more aesthetically appealing than the typical rack mount system.

NTIS

Manufacturing; Modules; Silicon Films; Solar Cells

20060005738 Department of Energy, Washington, DC, USA
DOE Solar Energy Technologies Program, FY 2004 Annual Report

Sep. 2005; 200 pp.; In English

Report No.(s): DE2005-15020473; No Copyright; Avail.: Department of Energy Information Bridge

The Solar Energy Technologies Program, located within the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy, is responsible for developing solar energy technologies that can convert sunlight to useful energy and

make that energy available to satisfy a significant portion of our nation's energy needs in a cost-effective way. The Solar Program supports research and development that addresses a wide range of applications, including on-site electricity generation, thermal energy for space heating and hot water, and large-scale power production. This is a great time to be involved with solar energy. Photovoltaic (PV) systems are being installed in the USA and around the world in unprecedented quantities. The concentrating solar power industry has broken ground on its first major plant in more than 10 years, and, with strong support from the Western Governor's Association, more plants are planned over the next few years. One of the largest segments of the solar industry is solar pool heating, and we are working with U.S. industry to leverage this expertise into new solar water heating products.

NTIS

Energy Technology; Solar Energy

20060005750 National Renewable Energy Lab., Golden, CO USA, ITN Energy Systems, Inc., Littleton, CO, USA
Trajectory-Oriented and Fault-Tolerant-Based Intelligent Process Control for Flexible CIGS PV Module Manufacturing. Final Technical Report, May 13, 2002-May 30, 2005

Simpson, L.; Britt, J.; Birkmire, R.; Vincent, T.; Oct. 2005; 70 pp.; In English

Report No.(s): DE2005-15020505; NREL/SR-520-38681; No Copyright; Avail.: National Technical Information Service (NTIS)

ITN Energy Systems, Inc., and Global Solar Energy, Inc., with the assistance of NREL's PV Manufacturing R&D program have continued the advancement of CIGS production technology through the development of trajectory oriented predictive/control models, fault tolerance control, control platform development, in-situ sensors, and process improvements. Modeling activities included the development of physics-based and empirical models for CIGS and sputter deposition processing, implementation of model-based control, and application of predictive models to the construction of new evaporation sources and for control. Model-based control is enabled through implementation of reduced or empirical models into a control platform. Reliability improvement activities include implementation of preventive maintenance schedules; detection of failed sensors/equipment and reconfiguration to continue processing; and systematic development of fault prevention and reconfiguration strategies for the full range of CIGS PV production deposition processes. In-situ sensor development activities have resulted in improved control and indicated the potential for enhanced process status monitoring and control of the deposition processes. Substantial process improvements have been made, including significant improvement in CIGS uniformity, thickness control, efficiency, yield, and throughput. In large measure, these gains have been driven by process optimization, which in turn have been enabled by control and reliability improvements due to this PV Manufacturing R&D program. This has resulted in substantial improvements of flexible CIGS PV module performance and efficiency. This program has also resulted in implementation of fully functional process control software with accompanying graphical user interfaces to enable implementation of model-based control and reconfiguration capabilities and in-situ sensor based real-time control. Finally, the program has been leveraged to develop improved processing systems both at the component and configuration levels.

NTIS

Copper; Fault Tolerance; Gallium; Indium; Manufacturing; Photovoltaic Conversion; Selenides; Trajectories

20060006374 National Renewable Energy Lab., Golden, CO USA
PowerLight Corporation Lean Manufacturing, PV Manufacturing R&D Phase 1 Report 6 December 2001-31 March 2003

Hargis, L.; Botkin, J.; Jun. 2005; 38 pp.; In English

Report No.(s): DE2005-15016394; NREL/SR-520-35581; No Copyright; Avail.: National Technical Information Service (NTIS)

PowerLight Corporation (PowerLight) has completed Phase I of its PV Manufacturing R&D subcontract, PowerGuard(Trade Name) Lean Manufacturing, Subcontract No. NDO-1-30628-04. The overall technical goal of this project was to reduce the cost of PowerGuard manufacturing while simultaneously improving product quality. This will enable PowerLight to scale up production capacity as the market for PowerGuard continues to grow. Through the introduction of world-class lean manufacturing techniques, PowerLight was to cut out waste in the manufacturing process of PowerGuard. The manufacturing process was to be overhauled with an objective of removing as much as possible those steps that do not add value to the product. Quality of finished goods was also to be improved through the use of statistical process control and error-proofing in the manufacturing process. Factory operations were also to be addressed in order to streamline those factory activities that support the manufacturing process.

NTIS

Manufacturing; Power Supplies; Photovoltaic Conversion; Research and Development

20060006414 National Renewable Energy Lab., Golden, CO USA

Plasma-Assisted Co-evaporation of S and Se for Wide Band Gap Chalcopyrite Photovoltaics: Final Subcontract Report, December 2001 -- April 2005

Repins, I.; Woldem, C.; Aug. 2005; 62 pp.; In English

Report No.(s): DE2005-15016822; NREL/SR-520-38357; No Copyright; Avail.: National Technical Information Service (NTIS)

In this work, ITN Energy Systems (ITN) and lower-tier subcontractor Colorado School of Mines (CSM) explore the replacement of the molecular chalcogen precursors during deposition (e.g., Se₂ or H₂Se) with more reactive chalcogen monomers or radicals (e.g., Se). Molecular species are converted to atomic species in a low-pressure inductively coupled plasma (ICP). This program explored the use of plasma-activated chalcogen sources in CIGS co-evaporation to lower CIGS deposition temperature, increase utilization, increase deposition rate, and improve S:Se stoichiometry control. Plasma activation sources were designed and built, then operated and characterized over a wide range of conditions. Optical emission and mass spectrometry data show that chalcogens are effectively dissociated in the plasma. The enhanced reactivity achieved by the plasma processing was demonstrated by conversion of pre-deposited metal films to respective chalcogen-containing phases at low temperature and low chalcogen flux. The plasma-assisted co-evaporation (PACE) sources were also implemented in CIGS co-evaporation. No benefit from PACE was observed in device results, and frequent deposition failures occurred.

NTIS

Broadband; Energy Gaps (Solid State); Evaporation; Photovoltaic Conversion; Plasmas (Physics); Solar Energy

45

ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20060005681 Energy Information Administration, Washington, DC, USA

Emissions of Greenhouse Gases in the USA 2004

Dec. 2005; 134 pp.; In English

Report No.(s): PB2006-102674; DOE/EIA-0573(2004); No Copyright; Avail.: CASI: [A07](#), Hardcopy

Contents: 1. U.S. Emissions of Greenhouse Gases: Background and Context: U.S. Emissions in a Global Perspective; The Greenhouse Effect and Global Climate Change; Current U.S. Climate Change Initiatives; and International Developments in Global Climate Change. 2. Carbon Dioxide Emissions: Energy Consumption; Adjustments to Energy Consumption; Other Carbon Dioxide Emissions. 3. Methane Emissions: Energy Sources; Waste Management; Agricultural Sources; and Industrial Processes. 4. Nitrous Oxide Emissions: Agriculture; Energy Use; Industrial Sources; and Waste Management. 5. Other Gases: Hydrofluorocarbons (HFCs); Perfluorocarbons (PFCs); Other HFCs and PFCs/PFPEs; Sulfur Hexafluoride (SF₆). 6. Land-Use Issues: New IPCC Good Practice Guidance for Land Use, Land-Use Change, and Forestry; Land-Use Change and Forestry Carbon Sequestration; Land Use and International Climate Change Negotiations; Land-Use Data Issues.

NTIS

Greenhouse Effect; United States; Climate Change; Forest Management

20060005685 Environmental Protection Agency, Research Triangle Park, NC, USA

Usando Plasma no Termico para Controlar Contaminantes del Aire (Using Non-Thermal Plasma to Control Air Pollutants)

Nov. 2005; 24 pp.; In Spanish

Report No.(s): PB2006-104822; EPA/456/R-05/006; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Clean Air Technology Center (CATC) serves as a resource on all areas of emerging and existing air pollution prevention and control technologies, and provides public access to data and information on their use, effectiveness and cost. In addition, the CATC will provide technical support, including access to EPA's knowledge base, to government agencies and others, as resources allow, related to the technical and economic feasibility, operation and maintenance of these technologies.

NTIS

Air Pollution; Plasma Control; Plasmas (Physics); Pollution Control; Thermal Plasmas

20060005687 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

Technical Support Document for the Equipment Replacement Provision of the Routine Maintenance, Repair and Replacement Exclusion: Reconsideration

Jun. 06, 2006; 96 pp.; In English

Report No.(s): PB2006-104804; EPA/456/R-05/003; No Copyright; Avail.: CASI: [A05](#), Hardcopy

On October 27, 2003, EPA promulgated the Equipment Replacement Provision (ERP), a rule for the NSR permitting program that prospectively defined what types of equipment replacements are excluded from major NSR under the RMRR exclusion. The ERP rule would simplify the permitting process and help preserve the nation's productive capacity (see CAA, Section 101 (b)(1)) without compromising air quality. On November 14, 2003 State and local governmental groups challenging the final rule asked the U.S. Court of Appeals for the District of Columbia Circuit to stay the final ERP (i.e., prevent the rules from taking effect) until the challenges are resolved by the Court. Several environmental groups filed a similar request on November 17, 2003. On December 24, 2003, the Court granted the requests and issued an order to stay the effective date of the ERP.

NTIS

Electricity; Energy Consumption; Furnaces; Heaters; Maintenance; Replacing; Water

20060005689 Energy Information Administration, Washington, DC, USA

Emissions of Greenhouse Gases in the USA, 2002. Executive Summary

Nov. 2003; 18 pp.; In English

Report No.(s): PB2006-104600; DOE/EIA-0573(2002/ES); No Copyright; Avail.: CASI: [A03](#), Hardcopy

The first report in this series, Emissions of Greenhouse Gases 1985-1990, was published in September 1993. This report-the eleventh annual report, as required by law-presents the Energy Information Administration's latest estimates of emissions for carbon dioxide, methane, nitrous oxide, and other greenhouse gases. These estimates are based on activity data and applied emissions factors and not on measured or metered emissions monitoring.

NTIS

Air Pollution; Exhaust Emission; Exhaust Gases; Greenhouse Effect; Pollution Control; United States

20060005713 EnviRes, LLC, Lexington, KY, USA

Reducing Ultra-Clean Transportation Fuel Cost with HyMelt Hydrogen. Quarterly Report

Malone, D. P.; Renner, W. R.; Oct. 2005; 28 pp.; In English

Report No.(s): DE2005-859294; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes activities for the twelfth quarter of work performed under this agreement. The design of the vessel for pressure testing has been finalized. We have initiated the purchasing process for the vessel and related equipment. Siemens Westinghouse Power Corporation completed computational fluid dynamics modeling and chemical reaction modeling of catalytic combustion of HyMelt product gases.

NTIS

Clean Fuels; Costs; Hydrogen; Transportation

20060005716 Los Alamos National Lab., NM USA

Emissions Inventory Report Summary: Reporting Requirement for the New Mexico Administrative Code, Title 20, Chapter 2, Part 73, (20.2.73 NMAC) for Calendar Year 2003

January 2005; 80 pp.; In English

Report No.(s): DE2005-841159; LA-14194-SR; No Copyright; Avail.: National Technical Information Service (NTIS)

Los Alamos National Laboratory is subject to annual emissions reporting requirements for regulated air pollutants under Title 20 of the New Mexico Administrative Code, Chapter 2, Part 73 (20.2.73 NMAC), Notice of Intent and Emissions Inventory Requirements. The applicability of the requirements is based on the Laboratory's potential to emit 100 tons per year of suspended particulate matter, nitrogen oxides, carbon monoxide, sulfur oxides, or volatile organic compounds. For calendar year 2003, the Technical Area 3 steam plant and the air curtain destructors were the primary sources of criteria air pollutants from the Laboratory, while the air curtain destructors and chemical use associated with research and development activities were the primary sources of volatile organic compounds and hazardous air pollutants. Emissions of beryllium and aluminum were reported for activities permitted under 20.2.72 NMAC. Hazardous air pollutant emissions were reported from chemical use as well as from all combustion sources. In addition, estimates of particulate matter with diameter less than 2.5 micrometers

and ammonia were provided as requested by the New Mexico Environment Department, Air Quality Bureau.
NTIS

Inventories; Environmental Quality; Exhaust Emission

20060005717 Texas Univ., Austin, TX, USA

CO₂ Capture by Absorption with Potassium Carbonate

Rochelle, G. T.; Hilliard, M.; Chen, E.; Oyekan, B.; Dugas, R.; Oct. 26, 2005; 80 pp.; In English
Report No.(s): DE2005-859276; No Copyright; Avail.: National Technical Information Service (NTIS)

The objective of this work is to improve the process for CO₂ capture by alkanolamine absorption/stripping by developing an alternative solvent, aqueous K₂CO₃ promoted by piperazine. Modeling of stripper performance suggests that vacuum stripping may be an attractive configuration for all solvents. Flexipac 1Y structured packing performs in the absorber as expected. It provides twice as much mass transfer area as IMTP no. 40 dumped packing. Independent measurements of CO₂ solubility give a CO₂ loading that is 20% lower than that Cullinane's values with 3.6 m PZ at 100-120 deg. C. The effective mass transfer coefficient (K_G) in the absorber with 5 m K₂CO₃/2.5 m PZ appears to be 0 to 30% greater than that of 30 wt% MEA.

NTIS

Carbon Dioxide; Carbonates; Potassium

20060005749 Envair, Albany, CA, USA

Spatial and Temporal Characterization of Fine Particulate Matter Mass Concentrations in California, 1980-2002

Blanchard, C. L.; Tanenbaum, S.; Dec. 2005; 158 pp.; In English

Report No.(s): PB2006-101640; ARB/R-05-841; No Copyright; Avail.: CASI: [A08](#), Hardcopy

Studies of fine particulate matter (PM) levels, trends, and effects in California need a reliable long-term record of ambient fine PM mass concentrations. Systematic measurement of fine PM mass concentrations began nationally with implementation of the Federal Reference Method (FRM) network in 1998 and 1999. However, a variety of other monitoring networks have measured fine PM mass concentrations, other PM size fractions, and related pollutants during various periods of time and at varying numbers of sites in California from 1980 through 2002. We developed a historical record of fine PM mass concentrations by combining data from different monitoring programs, accounting for differences in measurement methods and accuracy. The product of this work is a database consisting of estimates of monthly-average fine PM mass concentrations and their uncertainties at monitoring sites in California for the period from 1980 through 2002.

NTIS

Air Pollution; Particulates; Contaminants

20060005753 University of Western Kentucky, Bowling Green, KY, USA

Establishment of an Environmental Control Technology Laboratory with a Circulating Fluidized-Bed Combustion System. Quarterly Technical Progress Report for July 1-September 30, 2005

Pan, W. P.; Li, S.; Riley, J. T.; Oct. 2005; 22 pp.; In English

Report No.(s): DE2005-859243; No Copyright; Avail.: National Technical Information Service (NTIS)

This report is to present the progress made on the project 'Establishment of an Environmental Control Technology Laboratory (ECTL) with a Circulating Fluidized-Bed Combustion (CFBC) System' during the period July 1, 2005 through September 30, 2005. The following tasks have been completed. First, the construction of the Circulating Fluidized-Bed (CFB) Combustor Building was completed. The experimental facilities have been moved into the CFB Combustor Building. Second, the fabrication and manufacture of the CFBC Facility is in the final stage and is expected to be completed before November 30, 2005. Third, the drop tube reactor has been remodeled and installed to meet the specific requirements for the investigation of the effects of flue gas composition on mercury oxidation. This study will start in the next quarter. Fourth, the effect of sulfur dioxide on molecular chlorine via the Deacon reaction was investigated. The experimental results from this study are presented in this report. Finally, the proposed work for the next quarter is described in this report.

NTIS

Circulation; Combustion; Environmental Control

20060006329 Energy Information Administration, Washington, DC, USA

Documentation for Emissions of Greenhouse Gases in the USA, 2003

May 2005; 278 pp.; In English

Report No.(s): PB2006-104621; DOE/EIA-0573(2003); No Copyright; Avail.: CASI: [A13](#), Hardcopy

The first report in this series, Emissions of Greenhouse Gases 1985-1990, was published in September 1993. This report, as required by law, presents the Energy Information Administration's latest estimates of emissions for carbon dioxide, methane, nitrous oxide, and other greenhouse gases. These estimates are based on activity data and applied emissions factors and not on measured or metered emissions monitoring.

NTIS

Air Pollution; Exhaust Emission; Exhaust Gases; Greenhouse Effect; Pollution Control; United States

20060006411 National Renewable Energy Lab., Golden, CO USA

Effects of Biodiesel on NO_x Emissions

McCormick, B.; Jun. 2005; 20 pp.; In English

Report No.(s): DE2005-15016824; NREL/PR-54038296; No Copyright; Avail.: National Technical Information Service (NTIS)

This document provides a presentation about the effects of biodiesel on nitrogen oxide emissions at the ARB Biodiesel Workshop on June 8, 2005.

NTIS

Diesel Fuels; Nitrogen Oxides

20060006429 Mineta Transportation Inst., San Jose, CA, USA

Verifying The Accuracy of land Use Models Used in Transportation and Air Quality Planning: A Case Study in the Sacramento, California, Region

Rodier, C. J.; Oct. 2005; 56 pp.; In English

Report No.(s): PB2006-101697; MTI-05-02; No Copyright; Avail.: CASI: [A04](#), Hardcopy

Governmental bodies in the USA are implementing more advanced land use and travel demand models to meet air quality conformity and environmental impact statement requirements. To help guide model applications in policy studies, this report describes an evaluation of model accuracy and induced demand representation over a 10-year period in an integrated land use and transportation model, the 2000 Sacramento MEPLAN model.

NTIS

Accuracy; Air Quality; Land Management; Land Use; Planning; Transportation

20060006430 Pennsylvania State Univ., University Park, PA, USA

Model Hearing Conservation Program for Coal Miners

Bise, C. J.; Frank, T.; Jul. 2004; 224 pp.; In English

Report No.(s): PB2006-101273; No Copyright; Avail.: CASI: [A10](#), Hardcopy

This report summarizes the results of five-year study conducted by the Pennsylvania State University (University Park, PA 16802) concerning the noise generated in underground coal mines and the development of a model hearing conservation program for underground coal miners. It was supported by CDC/NIOSH under Cooperative Agreement U60/CCU315855-02. An underground coal mine in eastern Ohio was the primary site for data collection and implementation of the various components of the model hearing conservation program.

NTIS

Coal; Conservation; Health; Hearing; Noise Pollution; Safety

47

METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20060005693 National Centers for Environmental Prediction, Silver Spring, MD USA

Cooperative Station Observations

Jul. 1989; 98 pp.; In English

Report No.(s): PB2006-103685; No Copyright; Avail.: CASI: [A05](#), Hardcopy

The purpose of this handbook is to provide guidelines for taking and reporting observations at cooperative stations. The instructions pertain to the exposure, operation, and maintenance of instruments and equipment used by the observer. Instructions also cover taking and reporting observations. A cooperative station is a station at which observations are taken

or other services rendered by private citizens, institutions (such as utilities and television stations), etc. Services rendered usually consist of taking instrumental or visual observations and transmitting reports.

NTIS

Handbooks; Visual Observation; Television Systems

20060005714 Pacific Northwest National Lab., Richland, WA, USA

Hanford Site Climatological Summary 2004 with Historical Data

Hoitink, D. J.; Burk, K. W.; Ramsdell, J. V.; Shaw, W. J.; May 2005; 196 pp.; In English

Report No.(s): DE2005-859998; PNNL-15160; No Copyright; Avail.: National Technical Information Service (NTIS)

This document presents the climatological data measured at the U.S. Department of Energy's Hanford Site for calendar year 2004. Pacific Northwest National Laboratory operates the Hanford Meteorology Station and the Hanford Meteorological Monitoring Network from which these data were collected. This report contains updated historical information for temperature, precipitation, wind, normal and extreme values of temperature and precipitation, and other miscellaneous meteorological parameters. Further, the data are adjunct to and update Hoitink et al. (1999, 2000, 2001, 2002, 2003, 2004) and Hoitink and Burk (1994, 1995, 1996, 1997, 1998); however, data from Appendix B - Wind Climatology (Hoitink and Burk 1994) are excluded. Calendar year 2004 was warmer than normal at the Hanford Meteorology Station with an average temperature of 54.6 deg. F, 1.0 deg. F above normal (53.6 deg. F). The hottest temperature was 107 deg. F on August 13, while the coldest was -14 deg. F on January 5. For the 12-month period, 7 months were warmer than normal, and 5 months were cooler than normal. Precipitation for 2004 totaled 7.96 inches, 114% of normal (6.98 inches); calendar year snowfall totaled 22.9 inches (compared to the normal of 15.4 inches). The 11.4 inches of snow which fell on January 1 was the greatest amount ever recorded during a 24-hour period. The previous record was 10.2 inches on February 18-19, 1993. Calendar year 2004 had an average wind speed of 7.0 miles per hour (mph), 0.6 mph below normal (7.6 mph). There were 22 days with peak gusts greater than or equal to 40 mph, compared to a yearly average of 27 days. The peak gust during the year was 63 mph on January 30. The heating-degree days for 2003-2004 were 4,998 (3% below the 5,160 normal). Cooling-degree days for 2004 were 1,135 (12% above the 1,014 normal).

NTIS

Climatology; Histories

20060006426 Southeastern Forest Experiment Station, Asheville, NC, USA

Rainfall Interception by Hardwood Forest Litter in the Southern Appalachians

Helvey, J. D.; Feb. 1964; 54 pp.; In English

Report No.(s): PB2006-102642; FSRP-SE-8; No Copyright; Avail.: CASI: [A04](#), Hardcopy

The portion of rainfall over forest cover which does not reach mineral soil can be separated into the parts evaporated from the canopy and from the litter. Canopy interception loss is usually estimated by subtracting the sum through fall (water falling through tree crowns) and stem flow (water running down stems) from rainfall measured in forest openings (Hamilton and Rowe 1949). Litter interception loss is defined here as the volume of water retained the L and F layers of the forest floor and later evaporated without reaching mineral soil. Canopy interception has been investigated in many parts of the world, but litter interception has received little attention, and the total amount of water evaporated from litter in hardwood forests has never been accurately determined. This paper presents results from a study of rainfall intercepted by litter in a southern Appalachian hardwood stand.

NTIS

Appalachian Mountains (North America); Forests; Interception; Rain

51

LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance of animals and plants in space and related environmental conditions. For specific topics in life sciences see *categories 52 through 55*.

20060005582 Royal Netherlands Meteorological Inst., Netherlands

The Expeditionary Medical Kit Packed Up: From Case Study to Concept Method

Oudendijk, M. L. W.; Hin, A. J. S.; November 2005; 31 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): V403

Report No.(s): TD2005-0184; Copyright; Avail.: Other Sources

This report describes the first phase of the project 'Expeditionary Medical Kits'. The project is part of the research program Improvement of Military Healthcare (403). The project focuses on the achievement of knowledge in the field of medical packing and assembling. It seeks methods to compose medical equipment on functional grounds which are easy transportable and quickly usable. The concept method is just a part of the realization of a medical kit. The method needs input about the medical tasks the kit is designed for and about the composition and number of articles. The concept method supports the selection of the package as well as the selection, structuring and packing of the contents. The repacked AMA-set showed that classifying articles based on functionality and order of use produced a useful expeditionary medical kit. The concept method can be used to judge suitability of a package and to optimize the layout of modules of articles inside the package. The concept method also proved to be applicable to the much less complicated First Aid Individual Kit. Due to the simplicity of the kit and the low classifiability of articles on functionality or order of use, geometry overrules all other criteria. Two extra criteria were found in the analysis of the First Aid Individual Kit, and were added to the concept method. The concept method must be tested on other expeditionary medical kits to assess completeness of its criteria. In applying the method, knowledge management about medical kits is recommended.

Derived from text

Medical Equipment; First Aid; Kits

20060005586 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands

A PBPK model for Soman

Trap, H. C.; vanderSchans, M. J.; November 2005; 61 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): V013-A01D4BD; TNO Proj. 014.12898

Report No.(s): TD2005-0187; Copyright; Avail.: Other Sources

This report describes the development of a Physiologically Based Pharmacokinetic (PBPK) model to simulate the toxicokinetics of soman in the guinea pig and in the human. A PBPK model is a computer simulation which predicts the 'late' of a chemical compound in a living organism. The model is visualized as a collection of compartments connected with each other by flow components (blood streams). In each compartment certain conditions exist with regard to enzymatic hydrolytic activity and amount of available binding sites which have their effect on the elimination of soman. The toxicokinetics of the nerve agent soman is since long one of the main topics of toxicological research, partly due to the fast inhibitory activity of acetylcholinesterase and the rapid 'aging' which makes development of an adequate therapy difficult. With reasonable success a PBPK model has been developed which adequately predicts the kinetics of the two most toxic isomers of soman. Next, by describing the metabolic processes good insight has been obtained into the secondary reactions. This model provides a first step towards the prediction of the toxicokinetics of nerve agents in man.

Author

Chemical Composition; Computerized Simulation; Guinea Pigs; Organisms; Human Beings; Kinetics; Toxicity; Enzyme Activity

20060005757 Hong Kong Univ., Hong Kong

16S rDNA Clone Library Screening of Environmental Sample Using Melting Curve Analysis

Zhang, Tong; Fang, Hebert Han-Ping; Journal of The Chinese Institute of Engineers. Special Issue: Chemical Engineering; Volume 28, No. 7; November 2005, pp. 1153-1156; In English; See also 20060005754

Contract(s)/Grant(s): HKU-10205753; Copyright; Avail.: Other Sources

A new method of screening a 16s rDNA clone library from an environmental sample is demonstrated using the non-specific fluorescent dye SYBR Green for the melting curve analysis of PCR-amplified DNA fragments. It is simple, easy and swift to operate. In addition, it requires little manual operation and the product may be still used for further analysis.

Author

Deoxyribonucleic Acid; Dyes; Fluorescence; Melting; Molecular Properties

20060005759 Minnesota Univ., Minneapolis, MN, USA

Stem Cell Culture Engineering

Ulloa-Montoya, F.; Seth, G.; Hu, W. S.; Verfaillie, c. M.; Journal of The Chinese Institute of Engineers. Special Issue: Chemical Engineering; Volume 28, No. 7; November 2005, pp. 1039-1052; In English; See also 20060005754

Contract(s)/Grant(s): NIH ROI-11697-636-7470; Copyright; Avail.: Other Sources

Stem cells have the capacity for self renewal and undergo multilineage differentiation. Stem cells isolated from both blastocysts and adult tissues represent valuable sources of cells for applications in cell therapy, drug screening and tissue

engineering. While expanding stem cells in culture, it is critical to maintain their self-renewal and differentiation capacity. In generating particular cell types for specific applications, it is important to direct their differentiation to the desired lineage. In vitro differentiation of stem cells usually produces a mixed population of different cell lineages with the desired cell type present only at a small proportion. Use of growth factors that promote differentiation, and expansion or survival of specific cell types are key in controlling the differentiation towards specific cell lineages. Our limited knowledge of their growth conditions as well as lack of appropriate markers associated with different stages of differentiation hinders the widespread use of stem cells. However, a variety of bioreactors exist for cell cultivation that can be readily adapted to provide a well controlled environment for studying the process of stem cell propagation and differentiation. Here we review the advances made in the field of stem cell culture; and discuss the employment of different platforms for stem cell cultivation that will facilitate the advancement of stem cell science into the realm of application based technology in the foreseeable future.

Author

Stem Cells; Tissue Engineering; Culture Techniques; Cells (Biology); Bioreactors; In Vitro Methods and Tests

20060005846

Evaluation of NIRS as an Assessment of Brain Activity Related to Different Levels of Workload in a Vigilance Task

November 2005; 18 pp.

Contract(s)/Grant(s): NNL04AA06G; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Two experiments were conducted with the primary aim of examining the sensitivity of a NIRS ISS instrument with associated BOXY 5 software to changes in neurological functioning stemming from prolonged vigilance and differential verbal versus spatial working memory resource requirements. Experiment 1 examined measures of EEG bandwidth in an effort to validate the processing requirements of the experimental tasks to be utilized. Experiment 2 examined levels of oxygenated and deoxygenated hemoglobin obtained with the NIRS optical imaging system. Results indicate that the NIRS system generally distinguished between levels of task difficulty and was marginally sensitive to time on task even with low statistical power due to a small sample size. NIRS results generally mirrored those obtained with EEG. The results of these two experiments indicate that NIRS shows promise as a potential tool for examining the neurological processing associated with complex task performance.

Author

Brain; Human Performance; Hemoglobin; Electroencephalography; Workloads (Psychophysiology); Verbal Communication; Tasks; Oxygenation; Task Complexity

20060006617 Research and Technology Organization, Neuilly-sur-Seine, France

Prevention of Cold Injuries

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Topics covered include: Prediction and Prevention of Frostbite; Predicting Temperature Limit Values for Cold Touchable Surfaces; Guidelines on the Risk and Time to Frostbite during Exposure to Cold Winds; Cardiovascular and Thermal Strain during Manual Work in Cold Weather; Foot Temperatures and Toe Blood Flow during a 12 km Winter Hike and Guard Duty; Static and Dynamic Evaluation of Biophysical Properties of Footwear: The Jozef Stefan Institute Sweating Thermal Foot Manikin System; Frostbite in Ski Boots for Marines; Phase Change Material in Hiking Boots Does Not Minimise the Risk of Cold Injury; Prevention of Facial Cold Injury with a Passive Heat and Moisture Exchanger; Cold Injury of Amputated Digits; The Effect of Gentle Exercise Prior to a Cold Sensitivity Test used to Classify Non-Freezing Cold Injury; Peripheral Vasodilation Responses to Prevent Local Cold Injuries; Assessment of Local Cold Tolerance of Individuals by using Conventional and Unconventional Methods Based on Observation of CIVD Reactivity; The Risk Index for Frostbite; Effect of the Forearm Tissue Temperature on the Cold Induced Vasodilation; Prevention of Cold Injuries: What can be Learned from Nerve Injury Patients?; and Hyperbaric Oxygen as an Adjunct Treatment of Freezing Cold Injury.

Derived from text

Blood Flow; Cardiovascular System; Dynamic Characteristics; Vasodilation; Cold Tolerance; Freezing; Frostbite

20060006618 Jozef Stefan Inst., Ljubljana, Slovenia

Hyperbaric Oxygen as an Adjunct Treatment of Freezing Cold Injury

Mekjavic, Igor B.; Gorjanc, Jurij; Mekjavic, Polona, Jaki; Bajrovic, Fajko; Milcinski, Metka; Prevention of Cold Injuries; May 2005, pp. 16-1 - 16-4; In English; See also 20060006617; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Although there is general agreement that the initial treatment of freezing cold injury (FCI) should be rapid rewarming to prevent direct injury from intracellular ice formation and protein denaturation, there is less conformity in the clinical intervention after rewarming. Medical treatment is directed towards the prevention of additional injury due to microvascular damage. With the exception of freezing cold injury, hyperbaric oxygen therapy is now accepted as an adjunct therapy for the management of all other acute traumatic peripheral ischaemias, such as crush injuries, compartment syndrome, thermal burns, compromised skin grafts and flaps, and threatened replantations. The present report documents our experience of using HBO as an adjunct therapy in the treatment of 10 FCI patients. All patients were experienced alpinists, which received their injury during expeditions in the Alps, Andes, Himalayas, and Pamir. All received field medical attention upon returning to base camp, and regardless of location managed to return to Ljubljana within a few days to a week for further treatment, which also included HBO therapy (HBOT). During HBOT patients were compressed to 2.5 ATA for 90 min and breathed 100% oxygen via an oro-nasal mask. During the 90-min therapy, subjects inspired 100% oxygen for 25 min followed by a 5 min air break. This was repeated 3 times. Bone scintigraphy was performed prior to the HBO treatment protocol in 7 patients. The number of HBOTs ranged from 11 to 30 per patient. In all cases, patients presented with oedema in the afflicted digits. Some patients also had haemorrhagic blisters and/or some necrosis. The progression of their recovery, and results of HBOT are largely dependent on the time between injury to the onset of HBOT, the magnitude of the injury, and the field treatment. In general, oedema subsided by the 3rd to 5th day of HBOT, and revitalisation of the affected region was evident on the 2nd day of HBOT. HBOT also caused the demarcation line to move distally. The efficacy of HBOT in the treatment of FCI depends on the time to treatment following injury. Accepting that frostbite is due, in part, to anoxia of the tissues, as a consequence of diminished circulation, then HBOT should certainly be considered as an adjunct therapy to enhance the rate of healing of the afflicted tissue, and reduce tissue loss.

Author

Cold Tolerance; Freezing; Frostbite; Burns (Injuries); Treatment; Hyperbaric Chambers; Oxygen

20060006619 Army Research Inst. of Environmental Medicine, Natick, MA, USA

Peripheral Vasodilation Responses to Prevent Local Cold Injuries

Castellani, John W.; O'Brien, Catherine; Prevention of Cold Injuries; May 2005, pp. KN2-1 - KN2-14; In English; See also 20060006617; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

One of the earliest responses to cold exposure is decreased blood flow to the extremities. This can occur simply with facial cooling or by direct cooling of the hands and feet. The sympathetic response that drives this decrease in blood flow is maximal with whole-body cooling. This decreased blood flow limits the heat delivery to the extremities, and subsequent tissue cooling is associated with a decrease in thermal comfort and physical performance and an increased risk of peripheral cold injury. Methods are needed to increase extremity blood flow to minimise these adverse effects. Peripheral blood flow can be altered several ways. These can be classified into 3 broad categories, physiological (cold-induced vasodilation, CIVD), behavioural (increased exercise intensity), and technological (external heating). The purpose of this review is to summarise the role of CIVD, exercise, and external heating on dilating peripheral tissues and preventing injury during cold exposure.

Author

Blood Flow; Vasodilation; Thermal Comfort; Physical Exercise; Exposure; Injuries

20060006620 Oulu Univ., Finland

Prediction and Prevention of Frostbite

Hassi, Juhani; Makinen, Tiina M.; Rintamaki, Hannu; Prevention of Cold Injuries; May 2005, pp. KN1-1 - KN1-10; In English; See also 20060006617; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Occurrence of frostbite: Among teenagers, the annual incidence of frostbite in Finland was 4.1% in boys and 2.4% in girls. Lifetime experience of frostbite was 44 % among men entering their military service. In Finland during the 6 to 12 month military service the prevalence of frostbite was 1.9 % and sequelae of hand frostbite were present in 63 %. Prediction of frostbite: Individual risk factors of frostbite (95% CI) are Raynaud's phenomenon, (OR 1.66 - 3.87), hand vibration (OR 1.07 - 4.03) and current smoking (OR 1.02 - 3.15). Development of frostbite is associated with fatigue, low physical activity, dehydration and use of alcohol. During military service independent risk factors for developing face and ear frostbite were the following: not wearing a hat with earflaps or a scarf, applying protective ointment, and travelling in an open vehicle. Prevention of frostbites: Screening before military service by e.g. a questionnaire assessing Raynaud's phenomenon, hand vibration and current smoking enables to identify personnel that are susceptible to frostbites. These persons may be either excluded from field operations, or be given special training on how to protect themselves. Education of officers and physicians

is essential in order to be able to plan and train for winter maneuvers. Protection from frostbites: Each individual should be aware of the early signs indicating an increased risk of frostbite and know how to protect themselves. Appropriate selection and use of winter clothing protects from frostbites. Wind-proof, dry and not too tight clothing should be preferred. Exercise leading to exhaustion should be avoided. During periods of inactivity, the metabolic heat production should be increased by muscular work if possible, or alternatively use additional clothing or seek shelter. Adequate nutrition and hydration protects against frostbites. It is not recommended to use ointments or wash the face with strong detergents prior to the cold exposure. Smoking should be avoided, as it increases the risk of developing frostbite. Frostbites related to contact cooling may be prevented by coating metal surfaces or using contact gloves.

Author

Frostbite; Protection; Prevention; Metabolism; Gloves

20060006621 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Soesterberg, Netherlands

Predicting Temperature Limit Values for Cold Touchable Surfaces

denHartog, Emiel A.; Prevention of Cold Injuries; May 2005, pp. 1-1 - 1-8; In English; See also 20060006617; Original contains color illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

During some occupational activities, workers have to handle objects or tools in cold environments. In other circumstances, contact between the hand and the cold surface might be accidental (e.g., when a worker touches a cold surface, a cooler, etc). In both cases, contact between the hands and the cold material can induce discomfort, pain or frostbite, and exposure to cold may negatively influence the dexterity and the manual sensitivity of the subject [1]. Four years ago the EU started to finance a research project to determine the maximum duration of touching and gripping materials in the cold. In four different European labs, six male and six female students participated in the study. All subjects touched 10cm x 10cm blocks of different materials: wood, nylon, steel and aluminium. The 5 materials chosen were representative of a wide range of thermal properties that are relevant to cold surfaces. The subjects were asked to touch with their index finger the materials maintained at temperatures ranging between -40 C and -5 C. Thermocouples were placed on the back of the hand and on the touching surface of the finger. The subjects scored their subjective ratings on scales of pain and numbness with 5 levels (0 to 4; from total absence to intolerable level). From all the experiments, an extensive data set was collected on cooling curves of the fingers touching the mentioned cold materials. From this data set general safety limits could be derived for touching cold surfaces of various materials. Additional modelling allowed extending the duration limits beyond the range of the data. Furthermore, recent developments in the modelling showed that the actual limits are leaning on the safe side, due to the measurement technique that has been used. In conclusion, touching experiments were conducted to determine the maximum allowable tolerable exposure duration at different temperatures and for different materials. This duration varies inversely as a function of the material constants and linearly as a function of the temperature of the material. Modelling this problem allows the development of exposure limits outside the experimental range and to improve the validity of the experimental limits.

Author

Cold Surfaces; Thermodynamic Properties; Exposure; Touch; Rangefinding; Predictions

20060006622 Defence Research and Development Canada, Toronto, Ontario, Canada

Guidelines on the Risk and Time to Frostbite during Exposure to Cold Winds

Ducharme, Michel B.; Brajkovic, Dragan; Prevention of Cold Injuries; May 2005, pp. 2-1 - 2-10; In English; See also 20060006617; Original contains color illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The objective of the present study was to define the risk and the time required to develop frostnip on the face during exposure to cold winds. Twelve subjects (6 males and 6 females) were exposed to sixteen 45 min tests where the wind intensity varied between 0, 16 and 32 km/h. The tests were conducted at 0, -10, -20, -30, -40 and 50 C (only 0 km/h wind was present at -50 C). During the tests, the subjects were dressed for thermal comfort, and rested seated while facing the wind with their bare face fully exposed to the cold wind. Each test was terminated when the elapsed time reached 45 min, or when frostnip developed. The results show that no frostnip was observed at 0 C and -10 C for any wind intensity. The frequency of frostnip development increases inversely with temperature, while the time to develop frostnip increases with temperature. At -20 C, 17 and 58% of the subjects developed frostnip for the 16 and 32 km/h wind conditions, while at 30 and -40 C, all the subjects developed frostnip at those conditions. For the no wind conditions, 0, 11, 22, and 60% of the subjects developed frostnip for the 20, -30, -40 and -50 C conditions, respectively. The time to develop frostnip decreased from 20 min at -20 C for the 16 and 32 km/h wind conditions to 14, 4, 2.5 and 1.5 min for the -30 C and 16 km/h, -30 C and 32 km/h, -40 C and 16 km/h, and -40 C and 32 km/h condition, respectively. It was concluded from these results that the risk of frostbite and times to

develop frostbite estimated from Siple and Passel are based on conditions that are too severe and need revision to include more mild conditions. A new guideline based on the new Wind Chill Index is proposed to protect the general population against the development of freezing injuries, particularly on the face.

Author

Exposure; Frostbite; Risk; Wind Velocity; Freezing

20060006623 Nuklearni Inst. Jozef Stefan, Ljubljana, Macedonia

Foot Temperatures and Toe Blood Flow during a 12 km Winter Hike and Guard Duty

Mekjavic, Igor B.; Kocjan, ina; Vrhovec, Miro; Golja, Petra; House, Carol; Eiken, Ola; Prevention of Cold Injuries; May 2005, pp. 5-1 - 5-4; In English; See also 20060006617

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Freezing and non-freezing cold injury occurs primarily in the toes. The cause of such an injury is a combination of low environmental temperature and decreased tissue perfusion. Cold-induced vasoconstriction enhances the rate of cooling of the tissue, and may cause irreversible damage depending on the final temperature of the tissue and duration of exposure to low temperatures. The risk of cold injury may be further potentiated by ischaemia caused by footwear. The present study evaluated toe temperatures and blood flow by an indirect method during a 12 km winter hike and guard duty. Subjects (10 males, 10 females) wearing a standard military issue winter clothing ensemble, participated in two separate trials. In one, they conducted a 12 km hike carrying a 20 kg backpack, on trails surrounding the Alpine military training facility Pokljuka (altitude 1360m). The hikes ranged from 3 to 4 hours. In the second trial, they conducted a 3 hr guard duty. During the 3-week study, the trails were covered with snow. The average (SD) ambient temperature during hikes and guard duties was 2.0 (3.8) C. In both trials we monitored the skin temperature gradient between the calf and big toe ($\Delta T_{\text{sub calf-toe}}$). This proximal-to-distal skin temperature gradient is considered an index of toe perfusion. Core temperature was monitored in the gastrointestinal tract (T_{gastro}) with a radio pill. Average skin temperature (T_{sk}) was determined from measurements made with thermistors at four sites, and the data recorded on a 40-channel data logger situated in the backpack. Breath-by-breath oxygen uptake and heart rate were monitored with a portable oxygen uptake system. During guard duty, average (SD) T_{gastro} remained stable, T_{sk} decreased from 33.8 (0.5) to 29.0 (1.3) C and T_{toe} from 27.7 (3.6) to 15.4 (2.3) C. During the hike, T_{gastro} increased significantly from 37.2 (0.23) to 38.18 (0.42) C. T_{sk} was maintained at approximately 32 C in both trials, and T_{toe} increased from 27.4 (3.5) to 31.2 (5.4) C. $\Delta T_{\text{sub calf-toe}}$ increased from 0.83 (0.59) to 14.7 (15.9) during guard duty, and decreased from 0.8 (3.7) to 1.7 (3.4) during the hike, indicating vasoconstriction during guard duty and vasodilatation during the hike. Peripheral vasodilatation, presumably as a result of the elevated core temperature, maintained average skin temperature constant during the 12 km hike, and increased toe temperature. In contrast, the low activity during the guard duty resulted in a stable core temperature, and peripheral vasoconstriction. The reduction in toe perfusion resulted in substantial decreases in toe temperature. Should this toe temperature prevail for a longer period, the risk of non-freezing cold injury would be imminent.

Author

Blood Flow; Winter; Feet (Anatomy); Skin Temperature (Biology)

20060006624 Jozef Stefan Inst., Ljubljana, Slovenia

Static and Dynamic Evaluation of Biophysical Properties of Footwear: The Jozef Stefan Institute Sweating Thermal Foot Manikin System

Mekjavic, Igor B.; Lenart, Borut; Vrhovec, Miro; Tomsic, Martin; Kakitsuba, Naoshi; Taylor, Nigel A. S.; Oakley, Howard; Prevention of Cold Injuries; May 2005, pp. 6-1 - 6-8; In English; See also 20060006617; Original contains color illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Freezing and non-freezing cold injury occurs predominantly in the extremities, with the feet being at greatest risk. Inappropriate footwear is the main cause for the aetiology of cold injury of the feet. Ensuring that footwear meets minimal biophysical standards is therefore essential in preventing cold injury. The aim of the present project was to design and develop a sweating thermal foot manikin with a gait simulator. The Thermal Foot Manikin System comprises a sweating thermal foot manikin, a gait simulator and a control unit. The foot manikin has 10 segments (big toe, remaining toes, sole, heel, medial foot, lateral foot, instep, anterior ankle, posterior ankle, mid calf) constructed of a silver- copper alloy. Each segment is heated with a 10 W heater positioned between the metal alloy plate and silicone body of the foot. The temperature of each segment is monitored with a PT1000 thermistor also attached to the metal alloy plate. Water is delivered to 6 sweat glands in each of the 10 segments, at a rate ranging from 18 microL/segment/hr to 1.8 L/segment/hr. The water is distributed over the segment surface by a thin cotton layer attached to the segment. Each segment is covered by a water impermeable, but water vapour

permeable membrane, ensuring that only water vapour crosses the membrane. The electrical power required to maintain the temperature of the surface of each segment is regulated by the control unit. In this manner, the resistance to water vapour may be determined from each of the 10 segments. By disconnecting the sweat gland activity, the same analysis provides a value of insulation for each segment. The manikin is attached to a gait simulator, which can simulate different stride magnitudes (0.2 to 0.4 m) and walking paces (up to 45/min). The gait simulator simulates the heel-to-toe action of walking and also simulates the ground reaction forces during simulated gait of individuals with a mass of up to 125 kg. The manikin also allows biomechanical analysis of footwear during simulated gait. The thermal foot manikin is able to analyse the static and dynamic biophysical properties of footwear in sub-zero environments. The differences in the results obtained in the static and simulated gait mode are due to friction between the foot manikin and footwear, and due to footwear design. In the biomechanical mode, the foot manikin allows the assessment of wear, as well as how such wear affects biophysical properties. The developed thermal foot manikin enables the customer to ensure that appropriate footwear is chosen for a given environment, and gives industry the capability to develop footwear with biophysical properties specified by the customer. Such a strategy in the design and development of footwear for cold and wet environments will reduce the risk of cold injury.

Author

Freezing; Dynamic Characteristics; Biodynamics; Injuries; Control Equipment

20060006625 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Eindhoven, Netherlands

Frostbite in Ski Boots for Marines

Heus, Ronald; Schols, Ed; Kistemaker, Lyda; Prevention of Cold Injuries; May 2005, pp. 7-1 - 7-7; In English; See also 20060006617; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Previous research have showed that cold injuries of feet occur more often than cold injuries of hands. Recently, an unexpectedly large number of cold injuries were observed during military training in Norway and a relationship between cold injuries and the use of the Alico ski boot was suspected. The Marine Corps and the Defence Clothing agency asked TNO to investigate whether the Alico ski boot, in combination with the Berghaus gaiter, and the arctic sock would lead to an increased risk for cold injuries. Tests with several ski boot combinations were performed to measure the water vapour transport and the water tightness. Both worn and unworn ski boots were tested with and without a gaiter. The results were compared with the results of the Meindl climbing boot. The water vapour transport was measured using a thermal sweating foot model which was placed in a boot combination during three days for a couple of hours (indicate a more precise duration) a day. The water tightness was measured using a walking simulator where boots walked in a water tank. Both worn ski and climbing boots were tested by 8 marines in a climatic chamber of -18 C. The subjects rested on a chair in the climatic chamber for the first half hour, walked on a treadmill for the second half hour and stood still for the last half hour. Several skin temperatures (indicate the number of sites) of the feet were measured. The subjects also provided regular information about their thermal sensations and comfort. A worn ski boot has higher water vapour absorption and lower water vapour transmission than an unworn ski boot. During water evaporation periods about half of the water absorption evaporated from both worn and unworn boots. Wearing a gaiter with the ski boot gives a lower water vapour transmission and a higher resistance to heat. The ski boots have higher water vapour absorption, a slightly lower water vapour desorption and a slightly lower water vapour transmission than the climbing boot. None of the tested boots are waterproof. More water leaks in a worn ski boot than in an unworn ski boot. The climbing boot gives the best results on water tightness. No significant differences were found between the different kind of boot combinations concerning temperature and comfort and thermal sensations. Worn ski boots absorb more sweat and evaporate less sweat than unworn ski boots. By wearing a gaiter even less sweat can evaporate. The ski boots are not waterproof and water leaks in faster when shoes are worn. The climbing boots are not waterproof either, but water leaks in slower and the feet stay dry for longer periods. The boot combinations give equal temperatures and temperature decreases or increases. Also the comfort and thermal sensations are equal. The greatest problem is the ski boot not being waterproof which gives more leaking in of water and a faster cooling down of the feet. This could lead to earlier development of cold injuries.

Author

Frostbite; Injuries; Thermal Comfort; Perspiration; Boots (Footwear); Protective Clothing

20060006626 Jozef Stefan Inst., Ljubljana, Slovenia

Phase Change Material in Hiking Boots Does Not Minimise the Risk of Cold Injury

Mekjavic, Igor B.; Korosec, Bojana Andlovce; Tomsic, Martin; Golja, Petra; Prevention of Cold Injuries; May 2005, pp. 8-1 - 8-4; In English; See also 20060006617

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The present study compared the thermal insulation properties of identical hiking boots, incorporating a layer of either Sympatex or a layer of Outlast Phase Change Material (PCM). PCM contains paraffin filled microcapsules, which change their state of aggregation with temperature. During heating, PCM liquefies and absorbs a certain amount of energy. Conversely, during cooling PCM changes from a liquid to a solid state and releases thermal energy. Specifically, we evaluated whether PCM offers any significant protection against peripheral cooling and subsequent cold injury to the feet. Subjects (20 males and 20 females) participated in three trials. In two of these trials they immersed their booted feet, wrapped in a thin plastic bag, in 30 C for 15 min, followed by 3 hrs in 15 C water. On one occasion they wore boots with a PCM layer (PCM), and on the other, identical boots, but without a PCM layer (Control). At regular intervals we monitored tympanic temperature (Tty), average skin temperature of the arm, chest, thigh and calf (Tsk), foot temperature (6 sites), and heat flux from the skin of the foot (6 sites). Thermal insulation of the boots was determined separately with a thermal foot manikin. There was no change in Tty and Tsk during the three trials. There were no differences in any of the foot skin temperatures or heat flux measurements between the Outlast and Sympatex boots. The thermal insulation of the boots was 0.167 sq m K/W for the Sympatex and 0.163 sq m K/W for the Outlast boot. Phase change material does not offer any significant improvement in thermal protection, and thus does not minimise the risk of cold injury.

Author

Protection; Thermal Insulation; Thermal Protection; Injuries

20060006627 Jozef Stefan Inst., Ljubljana, Slovenia

Prevention of Facial Cold Injury with a Passive Heat and Moisture Exchanger

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The present study evaluated the thermodynamic characteristics of a prototype respiratory heat and moisture exchanger (HME), particularly its ability to prevent cold injury to the face. The HME comprised a thermally insulated oro-nasal mask with a cylindrical heat and moisture exchanger protruding from the centre of the mask. The heat exchanging unit contained an aluminium honeycomb structure providing a surface area of 478.5 square centimeters for exchange of heat and moisture between the inspired and expired air. A breathing simulator was used to simulate the temperature and humidity of the expired air. The HME was strapped to the head of a manikin, whose mouth was connected to the respiratory simulator. The entire arrangement was placed in a climatic chamber. We evaluated the efficiency of the HME at two different rates of ventilation (11.3 and 28.0 L. per minute), and at five different ambient conditions (-24, -14, -4, 8, and 22 C). The efficiency of the HME was evaluated by determining the performance coefficient (PC) under each condition: $PC(\%) = (T(\text{sub in}) - T(\text{sub a})) / (T(\text{sub ex}) - T(\text{sub a})) \times 100$; where $T(\text{sub in})$, $T(\text{sub ex})$, and $T(\text{sub a})$ are the temperatures of the inspired, expired and ambient air, respectively. In all subzero ambient conditions, the HME was able to maintain the temperature within the oro-nasal mask above 20 C. By maintaining mask temperature above 20 C in subzero temperatures, the HME can effectively eliminate the risk of freezing cold injury (FCI) of the facial region.

Author

Injuries; Face (Anatomy); Cold Tolerance; Moisture; Heat; Heat Exchangers

20060006628 Clinical Centre Ljubljana, Ljubljana, Slovenia

Cold Injury of Amputated Digits

Ahcan, Uros; Luzar, Bostjan; Bajrovic, Fajko; Mekjavic, Igor; Prevention of Cold Injuries; May 2005, pp. 10-1 - 10-4; In English; See also 20060006617

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Cooling of amputated parts during transportation delays the onset of ischaemic tissue damage and contributes to successful replantation. The most common error in preservation of amputated parts is exposing them to temperatures, which may cause cold injury, and thus render them unusable. Two case reports will be presented, which illustrate how freezing cold injury (FCI) of amputated digits may decrease the viability of such digits following replantation, and discuss the potential benefit of hyperbaric oxygen therapy (HBOT) in treating FCI of amputated digits following replantation. During the period 1998 to 2002, 124 injured individuals with severed digits were admitted to the Department of Plastic Surgery and Burns at the Ljubljana Clinical Centre. During this period, the number of attempted replantations increased from 29% in 1998 to 48% in 2002. The success rate of these replantations was 81%. Cold injury to the amputated parts was a significant factor affecting the replantation success rate in six patients. In all these cases, all fingers with the exception of the thumb were severed, and placed on ice for preservation during the transportation to the hospital. In all cases, the amputated digits suffered FCI, which

was noted after successful replantation. In one patient we assessed the benefit of administering HBOT to treat FCI of the replanted digits. Signs of FCI appeared three days after replantation. One patient received HBOT 7 days after replantation, whereas the others did not. Due to oedema and progressive necrosis observed in the replanted fingers of these patients, reamputation was necessary in most cases. The detrimental consequences of inappropriate preservation of the severed fingers at subzero temperatures were: non-freezing tissue damage, arterial and venous thrombosis during the microsurgical procedure, and longer operations. Post-operatively, improper preservation during transport caused complications associated with freezing- and non-freezing cold injury, despite successful reinstatement of perfusion to the replanted digits. Proper preservation of amputated body parts is essential for successful replantation. Hypothermic preservation is appropriate, if conducted properly. Since digits contain no muscle tissue, irreversible damage appears after significantly longer periods of ischaemia than in other types of tissue. Although we did not observe any benefit of HBOT in one patient, this is most likely due to the delay in initiating the treatment. HBOT should be administered immediately post-surgery, both to minimise reperfusion injury and freezing/non-freezing cold injury.

Author

Fingers; Burns (Injuries); Hypothermia; Freezing; Subzero Temperature

20060006629 Portsmouth Univ., Portsmouth, UK

The Effect of Gentle Exercise Prior to a Cold Sensitivity Test used to Classify Non-Freezing Cold Injury

Eglin, Clare; Golden, Frank; Tipton, Michael; Prevention of Cold Injuries; May 2005, pp. 11-1 - 11-5; In English; See also 20060006617; Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A cold sensitivity test (CST) is one of the assessments used to classify the level of non-freezing cold injury (NFCI) in patients presented to a cold injury clinic. The CST involves sitting in a chamber at 30 C for at least 30 min then immersing the injured site (usually a foot) in water at 15 C for 2 min. The NFCI classification is based on the skin temperature before and 5 min after immersion. Previous studies have indicated that this test may not be very reproducible. In addition, a proportion of uninjured individuals are classified as having a NFCI if this test is used in isolation. The purpose of this study was to examine whether elevating deep body temperature slightly by gentle exercise prior to conducting a CST would increase the reproducibility of the test. Six male subjects with no history of NFCI undertook 10 CSTs with and without prior exercise (stepping, cycling and arm cranking). The results indicated that stepping for approximately 10 min to elevate deep body temperature by 0.3 C reduced the variability in response observed and produced more 'normal' classifications compared to the control condition. An additional finding was that changes in skin temperature were not reflected in changes in blood flow measured using photoplethysmography. The implications of these findings are discussed.

Author

Sensitivity; Blood Flow; Freezing; Physical Exercise; Submerging; Injuries; Classifications; Body Temperature

20060006630 New Brunswick Univ., Fredericton, New Brunswick, Canada

Cardiovascular and Thermal Strain during Manual Work in Cold Weather

Geurts, Carla L. M.; Cheung, Stephen S.; Prevention of Cold Injuries; May 2005, pp. 3-1 - 3-8; In English; See also 20060006617; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In some occupations it is hard to protect the hands against the severe weather conditions in wintertime due to the requirement to maintain manual dexterity. Decrease in temperature of the hands increases risk of cold injury and deteriorates muscle function and manual dexterity, which in turn decreases productivity. A series of field and lab studies were performed to investigate cold stress and cold acclimation on the neuromuscular function of the hand. To quantify the cardiovascular and thermal strain during a working day in cold weather (17.6+/- 3.1 C (mean sd)), five line workers (4 male, 1 female, 36.4+/-4.4 y) from the maintenance crew of New Brunswick Power were equipped with skin thermistors and heart rate monitors and followed for a day (0900h - 1600h). Typical tasks were videotaped and a time log of activities and hand protection levels were recorded. Hand and finger temperature dropped as low as 17.0-24.4 C and 7.9-12.6 C, respectively. Average temperatures over the working day period varied from a hand temperature of 24.8-31.4 C to 21.0-29.8 C for the index finger. The lowest mean body skin temperature ranged from 21.0-29.4 C while on average, this was 25.6-34.1 C. Typical tasks included climbing poles, cutting wires, and shovelling snow. Peak heart rate (HR) was 148-181 b/min. Although the measurements took place during a day of relatively mild weather and light activity, skin temperature of fingers and hands decreased to a level that has been previously demonstrated to impair manual dexterity. The intensity level of certain tasks was as high as 82-97% of the age-predicted HRmax. It was concluded that alternating high intensity tasks with low intensity tasks demanding manual dexterity, will decrease cardiovascular strain and may improve manual performance by warming the body and hands. This field

study was followed up by laboratory experiments that were conducted to investigate the effects of physical activity and a resulting increase in core temperature (± 0.5 C) on cold acclimation and neuromuscular function of the hand. Neuromuscular function of the hand was tested before and after hand cooling in 8 C water for 30 min while either bicycling at a submaximal level or sitting at rest, before and after two weeks of local cold acclimation (30 min/day, 5 days/week). Neuromuscular tests consisted of tactile sensitivity, hand grip strength, manual dexterity and an evoked twitch force in a custom made myograph. Temperature of core, index finger and hand were recorded daily as well as subjective thermal ratings. Thermal ratings and index finger temperature increased significantly during acclimation days from 1.2 ± 0.7 (very cold) to 2.1 ± 1.3 (cold) ($P < 0.01$) and 8.7 ± 0.7 C to 10.1 ± 1.3 C ($P = 0.04$), respectively. Neuromuscular function was impaired with cooling and neither acclimation nor an elevation in core temperature had a significant effect on manual performance. Subjective thermal ratings were the first to acclimate even when no improvements in actual temperatures were seen. We conclude that the discrepancy between subjective and actual temperature may pose an additional risk of cold injury on people exposed to repeated cold stress by changing their behavioural thermal regulation response.

Author

Cardiovascular System; Temperature Effects; Skin Temperature (Biology); Protection; Neuromuscular Transmission; Muscular Function; Heart Rate; Acclimatization; Body Temperature; Cold Weather

20060006631 National Inst. of Industrial Health, Kawasaki, Japan

Assessment of Local Cold Tolerance of Individuals by using Conventional and Unconventional Methods Based on Observation of CIVD Reactivity

Sawada, Shin-ichi; Prevention of Cold Injuries; May 2005; 6 pp.; In English; See also 20060006617; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Cold-induced vasodilatation (CIVD), which occurs in fingers and toes exposed to extreme cold, is a defensive reaction of protecting the extremities against frostbite. Yoshimura and Iida (1950) developed a practical method, based on observation of CIVD reactivity, for assessing peripheral resistance against frostbite (local cold tolerance). Thereafter, many studies using this test method to clarify the factors affecting the local cold tolerance, such as occupation, gender, race, environmental temperature, clothing, ambient pressure and cold acclimatization have been conducted. Recent Japanese clinical studies have suggested that this local cold tolerance test is also useful for evaluating the sympathetic skin vasomotor function and a peripheral sensory nerve disturbance. These tests have, however, consisted of a 30-min immersion of fingers in ice water (0 C). Under these test conditions, most of the participants have tended to feel much pain and distress, and some have either fainted or had to withdraw prematurely from the experiment as a result. This means that vulnerable individuals, such as older persons or children, cannot participate in this stressful test. Consequently we proposed a simplified and less painful test for assessing the local cold tolerance (1983, 1984), as a substitute for the conventional test. Here I review some Japanese pioneering studies on factors governing the individual difference of the local cold tolerance which Yoshimura and Iida conducted by using their original method (conventional method). Also I refer to a study on applicability of our modified method (unconventional method) for assessing the local cold tolerance and summarize some of our recent findings on the factors affecting the local cold tolerance obtained by using the unconventional method.

Author

Vasodilation; Cold Acclimatization; Cardiovascular System; Reactivity; Frostbite; Cold Tolerance

20060006632 Institute for Human Factors TNO, Soesterberg, Netherlands

The Risk Index for Frostbite

Daanen, Hein A. M.; van der Struijs, Norbert; Prevention of Cold Injuries; May 2005, pp. 13-1 - 13-9; In English; See also 20060006617; Original contains color illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The lowest skin temperatures during operations in the cold are generally observed in the human extremities. The hands are particularly vulnerable since they are difficult to cover when manual dexterity is required. Fortunately, cold induced vasodilatation (CIVD) occurs at very low finger temperatures and this mechanism transports warm blood to the extremities. The magnitude of the CIVD-reaction differs considerably between subjects and there were some indications that those subjects with a fast CIVD reaction with high amplitude had a reduced risk for cold injuries. The purpose of this investigation was to monitor and describe the CIVD reaction in marines. Later, we evaluated whether marines in whom cold injuries occurred during operations in cold areas did have a poor CIVD response in previous tests. In order to evaluate the magnitude of the CIVD response, 226 marines immersed their left middle finger in ice water for 30 minutes. The Risk Index for Frostbite (RIF) according to Yoshimura was determined on the basis of the finger skin temperature response. This index ranges from 3 (high risk) to 9 (low risk) dependent on the response time and response magnitude. The calculated RIF was relatively good as

compared to a Japanese male soldiers (7.0 plus or minus 1.7 versus 5.7 plus or minus 1.7). Unexpectedly, smokers had a better RIF-score than non-smokers had. The RIF-score was inversely related to pain. One year later 54 marines obtained cold injuries during training in Norway. Twelve of them were in the measured pool of 226 marines. These twelve marines had a RIF of 5.3 plus or minus 1.6, as compared to 7.1 plus or minus 1.6 for the remaining marines. This was significantly different (t-test, $t = -3.6$, $df = 209$, p less than 0.001). In conclusion, the RIF shows considerable differences between subjects and the RIF, determined in a simple lab test, may be related to the risk for cold injuries during operations in the field.

Author

Frostbite; Risk; Skin Temperature (Biology); Cold Tolerance

20060006633 Defence Research and Development Canada, Toronto, Ontario, Canada

Effect of the Forearm Tissue Temperature on the Cold Induced Vasodilation

Ducharme, M. B.; Sessler, D. I.; Doufas, A.; Grief, R.; Prevention of Cold Injuries; May 2005, pp. 14-1 - 14-7; In English; See also 20060006617; Original contains color illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recent work suggests an influence of the mean body skin (T_{sk}) and deep body temperatures (T_b) on cold induced vasodilation (CIVD). For example, minimum finger temperature ($T_{fi,min}$) was lower, and the maximum finger temperature ($T_{fi,max}$) was greater during CIVD when T_b was elevated, and the onset time of the CIVD response was reduced at higher T_{sk} . Question remain, though, about the influence of forearm tissue temperature on CIVD at a given T_{sk} and T_b . On two different occasions, eleven healthy male subjects pre-conditioned their forearm tissue at two different water temperatures (T_w), 20 and 38 C, until steady state forearm muscle temperature was achieved. After the conditioning period (129 plus or minus 15 and 85 plus or minus 15 min for 20 and 38 C, respectively), the fingers of the conditioned forearm were immersed in a 5 C water bath for 30 min. During finger immersion, T_{sk} and T_b were similar at each forearm skin temperature ($T_{sk} = 34.3$ plus or minus 0.6 C, $T_b = 36.8$ plus or minus 0.2 C), but temperature 3cm deep into the forearm's flexor digitorum profundus muscle differed significantly, averaging 23.6 plus or minus 1.7 C when T_w was 20 C and 36.7 plus or minus 0.6 C when T_w was 38 C. Arterial blood temperature in the radial artery measured at the wrist averaged 28.2 plus or minus 2.5 and 35.6 plus or minus 0.9 C for the 20 and 38 C conditions, respectively (p less than 0.05). The two forearm conditions caused significant differences in all the CIVD parameters during the 30 min immersion in 5 C water. During the 38 C condition, the onset time for the CIVD was faster and the average, maximal and minimal T_{fi} were higher than during the 20 C condition. We concluded that a low forearm tissue temperature impedes the CIVD response despite normal T_{sk} and T_b , possibly by decreasing the temperature of the arterial blood to the fingers.

Author

Forearm; Skin Temperature (Biology); Vasodilation; Cold Tolerance; Tissues (Biology)

20060006634 Erasmus Univ., Rotterdam, Netherlands

Prevention of Cold Injuries: What can be Learned from Nerve Injury Patients?

Jaquet, J. B.; Brandsma, M.; Daanen, H. A. M.; Hovius, S. E. R.; Prevention of Cold Injuries; May 2005, pp. 15-1 - 15-6; In English; See also 20060006617; Original contains color illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Patients who acquired an upper extremity nerve injury often complain about cold intolerance, reduced sensitivity and decreased task performance. This study tried to quantify these complaints and look in more detail at the thermal reaction to local cold exposure of the affected limb. We found that 36% of 107 subjects could be classified as cold intolerant. Eight of the cold intolerant subjects immersed their hands in 15 C water for 5 minutes after which infrared pictures of their affected hands were taken. The cold strain was acceptable for the patients. The damaged regions could easily be identified, most clearly 5 minutes after the hands were removed from the water. We conclude that the infrared temperature profile of the damaged hand after cold water immersion may be a helpful tool to assess the nerve damage. Similar tests exist for assessing the severity of non-freezing cold injuries (NFCI). We suggest that comparison of the results between NFCI and nerve injury patients may yield interesting information about the nervous involvement in NFCI. The method may also be valuable to identify subjects that have a higher risk for cold injuries.

Author

Injuries; Nerves; Patients; Cold Water; Hand (Anatomy)

MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering, bionics, man-machine systems, life support, space suits and protective clothing. For related information see also *16 Space Transportation and Safety* and *52 Aerospace Medicine*.

20060005584 Royal Netherlands Meteorological Inst., Netherlands

(HFTUMV: Human Factors Tool for Unmanned Military Vehicles)

Jansen, C.; van Veen, H. A. H. C.; Duistermaat, M.; November 2005; 36 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): V104

Report No.(s): TD2005; Copyright; Avail.: Other Sources

Unmanned vehicles are becoming more and more involved in military operations. Some tasks are autonomously performed by these vehicles, whereas other tasks are remote-controlled by a remote human operator. TNO Defence, Security and Safety developed a method for evaluating the operator's interaction with (semi-)autonomous unmanned military vehicles. We developed a framework for describing how tasks are performed by the to be evaluated system. Specific for each kind of task performance, we grouped evaluation aspects and criteria that are based on published research on and experience with unmanned systems. These evaluation aspects primarily concern teleoperation and automation. The method is implemented as a computer program that lists evaluation aspects and criteria that are relevant for evaluating a particular unmanned system. A human factors expert uses this information for evaluating the unmanned system. The method can be used to identify possible improvements to existing systems. It could also be of help in acquiring or designing new unmanned vehicles, for example by making explicit user preferences and demands.

Author

Human Factors Engineering; Remote Control; Teleoperators; Man Machine Systems

20060006293 Air Force Office of Scientific Research, Arlington, VA, USA

Technical Evaluation Report

Larkin, Willard D.; New Directions for Improving Audio Effectiveness; April 2005, pp. T-1 - T-13; In English; See also 20060006290; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This Symposium was organized to consider the challenges and opportunities offered by new audio technologies such as active noise reduction systems and new designs for spatial audio displays. The participants included experts in human factors engineering, acoustics, speech and hearing science, audiology, military and occupational health & safety, and end users of the various devices for hearing protection and audio information portrayal. Thirty-two technical papers were scheduled, representing research and development efforts in eight nations. This Technical Evaluation Report describes the progress and continuing challenges brought to light in the Symposium papers and in the discussions provoked by these presentations.

Derived from text

Human Factors Engineering; Ear Protectors; Auditory Defects; Audiology; Bioacoustics

MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

20060005648 Newcastle-upon-Tyne Univ., Newcastle, UK

Investigating Atomicity and Observability

Burton, J.; Jones, C. B.; Jul. 2005; 32 pp.; In English

Report No.(s): PB2006-102761; CS-TR-920; Copyright; Avail.: National Technical Information Service (NTIS)

Using the fiction of atomicity as a design abstraction and then refining atomicity as we develop an implementation is widely used in areas of concurrent computing such as database systems and transaction processing. In each of these and similar areas, associated notions of correctness are used in order to show that a particular implementation artefact which exhibits concurrency is correct in some sense with respect to a (possibly notional) description which executes with a greater degree of sequentiality. Of crucial importance in the proof and deployment of such notions of correctness is the issue of observability: i.e. in what broad sense do (human or computer) users of a particular implementation artefact observe the effects of its executions. For example, if a human user is allowed to observe directly the execution of a particular concurrent component

then he or she will be able to detect the fact of concurrent - and so non-atomic - execution. In general, however, the notion of observability is treated implicitly or not at all. In this paper, we make it explicit and look at the issue of exploring more fully the connections between atomicity and observability. The ultimate aim of this consideration is to work towards constructing a more general framework for (software or hardware) development by refining atomicity.

NTIS

Data Bases; Software Engineering; Refining; Deployment; Proving

20060005649 Newcastle-upon-Tyne Univ., Newcastle, UK

Towards a Petri Net Semantics for Membrane Systems

Kleijn, H. C. M.; Koutny, M.; Rozenberg, G.; Jul. 2005; 24 pp.; In English

Report No.(s): PB2006-102760; CS-TR-919; Copyright; Avail.: National Technical Information Service (NTIS)

We consider the modelling of the behaviour of membrane systems using Petri nets. First, a systematic, structural, link is established between a basic class of membrane systems and Petri nets. To capture the compartmentisation of membrane systems, localities are proposed as an extension of Petri nets. This leads to a locally maximal concurrency semantics for Petri nets. We indicate how processes for these nets could be defined which should be of use in order to describe what is actually going on during a computation of a membrane system.

NTIS

Membranes; Petri Nets; Semantics

20060005650 Newcastle-upon-Tyne Univ., Newcastle, UK

Approach to the Formalisation of a Certification Policy

Batarfi, O.; Snow, C. R.; Jul. 2005; 16 pp.; In English

Report No.(s): PB2006-102759; CS-TR-918; Copyright; Avail.: National Technical Information Service (NTIS)

In this paper, we present an initial approach to the problem of specifying formally the requirements of the Certification Policy as published by a Certification Authority. The approach uses the XML language to describe the structure of the policy document, and attempts to provide a canonical representation of the document in order to allow the semantics of the policy to be described. The ultimate aim is to permit policies to be compared, thus allowing a degree of trust to be inferred between entities holding certificates issued by otherwise unconnected Certification Authorities.

NTIS

Certification; Policies; Document Markup Languages; Semantics

20060005653 Newcastle-upon-Tyne Univ., Newcastle, UK

CAMA: Structured Coordination Space and Exception Propagation Mechanism for Mobile Agents

Iliasov, A.; Romanovsky, A.; Jul. 2005; 18 pp.; In English

Report No.(s): PB2006-102758; CS-TR-917; Copyright; Avail.: National Technical Information Service (NTIS)

Exception handling has been proven to be the most general fault tolerance technique as it allows effective application-specific recovery. If exception handling is to make programmer's work more productive and less error-prone, however, it requires adequate support from the programming and execution environments. Scoping is a dynamic structuring technique which makes it easier for the developers to deal with the complexity of system execution by narrowing down the context visible for the individual system components. In this work we are specifically interested in scoping that supports error confinement and allows system error recovery to be limited to the area surrounding the error. The approach we propose aims at assisting in rigorous development of structured multilevel fault tolerant agent systems.

NTIS

Coordination; Fault Tolerance; Interoperability; Confinement; Programming Environments

20060005655 Newcastle-upon-Tyne Univ., Newcastle, UK

UK Performance Engineering Workshop (Twenty-First)

Thomas, N.; Jun. 2005; 208 pp.; In English

Report No.(s): PB2006-102757; CS-TR-916; Copyright; Avail.: National Technical Information Service (NTIS)

Welcome to the 21st UK Performance Engineering Workshop, being held for the first time in Newcastle. UKPEW is designed to be a forum for researchers across the UK and beyond to meet and share experiences of their work in the field of performance. This year the programme consists of eighteen submitted papers across five loosely themed sessions spread over two days. The papers reflect the rise of security, MANETs and web services as important growing concerns for performance

engineers, as well as the continued importance of more traditional topics, such as queueing theory.
NTIS

Performance Prediction; Reliability Engineering; Queueing Theory

20060005657 Newcastle-upon-Tyne Univ., Newcastle, UK

Method for Specifying Contract Mediated Interactions

Molina-Jimenez, C.; Shrivastava, S.; Warne, J.; Jun. 2005; 22 pp.; In English

Report No.(s): PB2006-102756; CS-TR-914; Copyright; Avail.: National Technical Information Service (NTIS)

To form and automatically manage partnerships within a virtual organisation, it is necessary to have an electronic representation of the contract governing business relationships that can be used to mediate the rights and obligations that each interacting entity promises to honour. The paper describes a general method of representing business interactions using a widely used modeling language Promela and discusses how to represent permissions, obligations, prohibitions, actors (agents), time constraints, and message type checking; that is, all the basic parameters that compose most typical business contracts. Two levels of contract representations are described: implementation neutral, and implementation specific, that is a refinement of the former to include technical details such as acknowledgements and synchronization messages that form an important part of any implementation.

NTIS

Organizations; Synchronism; Messages

20060005658 Newcastle-upon-Tyne Univ., Newcastle, UK

Voting Technologies and Trust

Randell, B.; Ryan, P. Y. A.; May 2005; 18 pp.; In English

Report No.(s): PB2006-102755; CS-TR-911; Copyright; Avail.: National Technical Information Service (NTIS)

In this paper, as a step towards the ultimate aim of developing an e-voting system that would be likely to gain and retain the trust of the general voting public, we describe a design for a manual voting scheme that has, we claim, significant security-related advantages over existing well-trusted manual schemes. We then use this design as the basis for a small set of (in most cases partially-automated) voting systems which could improve the efficiency of our proposed manual voting scheme, without endangering the public's trust. Our approach to the design of these schemes is thus as much socio-technical as technical.

NTIS

Voting; Automatic Control; Manuals; Security

20060005659 Swedish Defence Research Establishment, Linköping, Sweden

Simulated Task Environments in Commercial PC-Games as Test Beds

Wikberg, P.; Berggren, J.; Lindoff, J.; Thorstensson, M.; Dec. 2004; 112 pp.; In Swedish

Report No.(s): PB2006-100634; FOI-R-1416-SE; No Copyright; Avail.: CASI: [A06](#), Hardcopy

Commercial PC-games are a possible aid for training, evaluation and development of military command and control as they make it possible to, in a simple and low cost manner, simulate technology, methodology and organization of activities that normally demand extensive resources. One condition for using commercial PC-games for evaluation and training is that the behavior of units and commanders in the virtual and physical environment must have high correspondence. This study, conducted at the Norrlands Dragoon Regiment, investigated this correspondence. A virtual three-dimensional copy of one square kilometer of the regiments exercise range was created and integrated in a commercial PC-game. Ranger task forces, supported by a rear command post, accomplished the same mission both in real and virtual environment. In both environments the rear command post had access to real-time information from simulated UAV. The task forces' and the commander's execution of the mission in the two different environments were compared according to mission success, communication, situation awareness and the dynamic of the task. Data was gathered using observers, questionnaires and registration of radio communication. Results reveal that the task forces' performance and behavior was more or less the same in the different conditions. Simulated environments are therefore sufficient for training and experiments of this kind of mission. However, it should be noted that communication within task forces was more frequent in the virtual environment. Furthermore, the communication between commander and task force was more frequent in the real environment.

NTIS

Ammunition; Education; Games; Test Stands

20060005662 Newcastle-upon-Tyne Univ., Newcastle, UK

Automatic Parameterisation of Stochastic Petri Net Models of Biological Networks

Shaw, O. J.; Steggles, L. J.; Wipat, A.; May 2005; 26 pp.; In English

Report No.(s): PB2006-102753; CS-TR-909; Copyright; Avail.: National Technical Information Service (NTIS)

Stochastic simulations are able to capture the fine grain behaviour and randomness of outcome of biological networks not captured by deterministic techniques. As such they are becoming an increasingly important tool in the biological community. However, current efforts in the stochastic simulation of biological networks are hampered by two main problems: firstly the lack of complete knowledge of kinetic parameters; and secondly the computational cost of the simulations. In this paper we investigate these problems using the framework of stochastic Petri nets. We present a new stochastic Petri net simulation tool NASTY which allows large numbers of stochastic simulations to be carried out in parallel. We then begin to address the important problem of incomplete knowledge of kinetic parameters by developing a distributed genetic algorithm, based on NASTY's simulation engine, to parameterise stochastic networks. Our algorithm is able to successfully estimate kinetic parameters to replicate a systems behaviour and we illustrate this by presenting a case study in which the kinetic parameters are derived for a stochastic model of the stress response pathway in the bacterium E.coli.

NTIS

Parameterization; Petri Nets; Stochastic Processes

20060005663 Newcastle-upon-Tyne Univ., Newcastle, UK

Proposal for Trust-Enabled P2P Recommendation Systems

Pitsilis, G.; Marshall, L.; May 2005; 18 pp.; In English

Report No.(s): PB2006-102754; CS-TR-910; Copyright; Avail.: National Technical Information Service (NTIS)

In this paper we present a trust-oriented solution that can be used when building Peer-to-Peer recommendation systems. We discuss its benefits in comparison to a centralized solution, its requirements, its pitfalls and how these can be overcome. In our approach, we base the formation of trust on evidential reasoning and made the proposed design with ease of adoption by existing infrastructures in mind. The paper also includes a preliminary analysis of performance based on a simple model we use to investigate the impacts on scalability and thus show the applicability of the protocol.

NTIS

Computer Networks; Proving

20060005665 Newcastle-upon-Tyne Univ., Newcastle, UK

Overcoming Traceability Benefit Problem

Arkley, P.; Riddle, S.; Apr. 2005; 12 pp.; In English

Report No.(s): PB2006-102751; CS-TR-906; Copyright; Avail.: National Technical Information Service (NTIS)

To modify complex computer-based systems requires a detailed understanding of their functionality. Requirements Traceability can help the engineer to gain that understanding, but several surveys have observed that traceability information is poorly recorded. We argue that the cause is the lack of direct perceived benefit to the main development process. As a consequence traceability information will be incomplete, inaccurate and out-of-date. We propose a method of recording traceability information, a Traceable Development Contract (TDC), as a means of reducing this problem by tackling the issue of an upstream functional development team imposing changes on a downstream development team. The contract makes the recording of traceability information beneficial to the downstream functional team as it provides a means of specifying the obligations on the upstream team. We also consider the practicalities of implementing such a contract and how it could be further exploited to obtain project development metrics.

NTIS

Computers; Complex Systems; Project Management

20060005667 Newcastle-upon-Tyne Univ., Newcastle, UK

Relaxing Atomicity and Verifying Correctness: Considering the Case of an Asynchronous Communication Mechanism

Burton, J.; Apr. 2005; 38 pp.; In English

Report No.(s): PB2006-102750; CS-TR-905; Copyright; Avail.: National Technical Information Service (NTIS)

In an ideal world, where we could guarantee instantaneous, atomic data transfer - whatever the type of the data being transferred - shared memory communication between two concurrent processes could be implemented directly using single variables or registers, without any attendant access control policies or mechanisms. In practice, asynchronous communication mechanisms may be used to provide the illusion of atomic transfers of data while still allowing non-blocking reads and writes:

that is, reads and writes may proceed concurrently without interfering with each other. In order to prove the correctness of such mechanisms, the natural approach would be to verify them against the specification provided by an idealised register with atomic, instantaneous - and so sequential - transfers of data. Yet such a verification is complicated by the fact that, in moving to the asynchronous communication mechanism from such a specification, additional concurrency has been introduced and so the (visible) behaviours of the mechanism are not directly comparable to those of the register. In this paper, we recall an extension of standard process algebraic refinement and show how it may be used to verify the correctness of a particular asynchronous communication mechanism, Simpson's 4-slot. In so doing, we look at a number of issues which seem significant in the consideration of correctness when the real atomicity of a specification has been relaxed in the move from specification to implementation.

NTIS

Synchronism; Access Control

20060005673 Newcastle-upon-Tyne Univ., Newcastle, UK

Service-Oriented, Distributed, High-Performance Computing

Bryans, J.; Jul. 2005; 22 pp.; In English

Report No.(s): PB2006-102763; CS-TR-924; Copyright; Avail.: National Technical Information Service (NTIS)

In this work we explore the use of process algebra in formalising and analysing access control policies. We do this by considering a standard access control language (XACML) and show how the core concepts in the language can be represented in CSP. We then show how properties of these policies may also be described in CSP, and how model checking may be used to verify that a policy meets the property. We further consider how we may introduce a notion of workflow into this framework, and show that a simple appreciation of the workflow context may limit the things we need to verify about a policy.

NTIS

Access Control; Communicating; Policies

20060005674 Newcastle-upon-Tyne Univ., Newcastle, UK

Service-Oriented, Distributed, High-Performance Computing

Parastatidis, S.; Webber, J.; Jul. 2005; 18 pp.; In English

Report No.(s): PB2006-102762; CS-TR-922; Copyright; Avail.: National Technical Information Service (NTIS)

High-performance computing (HPC) has evolved from a discipline solely concerned with efficient execution of code on parallel architectures to be more closely aligned with the field of distributed systems. Modern HPC is as much concerned with access to data and specialised devices in wide-area networks as much as it is with crunching numbers as quickly as possible. The focus of HPC has shifted towards enabling the transparent and most efficient utilisation of a wide range of capabilities made available over networks, in as seamless a way as that the electrical grid delivers electricity. Such a vision requires significant intellectual and architectural investment. In this article we explore one service-oriented approach for enabling Internet-scale, high-performance applications.

NTIS

Wide Area Networks; Internets

20060005675 Newcastle-upon-Tyne Univ., Newcastle, UK

Theory and Practice of Refinement-After-Hiding

Burton, J.; Apr. 2005; 370 pp.; In English

Report No.(s): PB2006-102749; CS-TR-904; Copyright; Avail.: National Technical Information Service (NTIS)

In software or hardware development, we take an abstract view of a process or system - i.e. a specification - and proceed to render it in a more implementable form. The relationship between an implementation and its specification is characterised in the context of formal verification using a notion called refinement: this notion provides a correctness condition which must be met before we can say that a particular implementation is correct with respect to a particular specification. For a notion of refinement to be useful, it should reflect the ways in which we might want to make concrete our abstract specification. In process algebras, the notion that a process Q implements or refines a process P is based on the idea that Q is more deterministic than P: this means that every behaviour of the implementation must be possible for the specification. Consider the case that we build a (specification) network from a set of (specification) component processes, where communications or interactions between these processes are hidden. The abstract behaviour which constitutes these communications or interactions may be implemented using a particular protocol, replication of communication channels to mask possible faults or perhaps even parallel access to data structures to increase performance. These concrete behaviours will be hidden in the construction of the

final implementation network and so the correctness of the final network may be considered using standard notions of refinement. However, we cannot directly verify the correctness of component processes in the general case, precisely because we may have done more than simply increase determinism in the move from specification to implementation component. Standard (process algebraic) refinement does not, therefore, fully reflect the ways in which we may wish to move from the abstract to the concrete at the level of such components. This has implications both in terms of the state explosion problem and also in terms of verifying in isolation the correctness of a component which may be used in a number of different contexts. We therefore introduce a more powerful notion of refinement, which we shall call refinement-after-hiding: this gives us the power to approach verification compositionally even though the behaviours of an implementation component may not be contained in those of the corresponding specification, provided that the (parts of the) behaviours which are different will be hidden in the construction of the final network. We explore both the theory and practice of this new notion and also present a means for its automatic verification. Finally, we use the notion of refinement-after-hiding, along with the means of verification, to verify the correctness of an important algorithm for asynchronous communication. The nature of the verification and the results achieved are completely new and quite significant.

NTIS

Proving; Channels (Data Transmission); Computer Programming; Data Structures; Program Verification (Computers); Protocol (Computers)

20060005679 Interior Dept., Washington, DC USA

Interior Enterprise Architecture Conceptual Architecture Principles, January 4, 2002

Jan. 04, 2002; 20 pp.; In English

Report No.(s): PB2006-102676; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The Clinger-Cohen Act of 1996 requires the heads of Federal agencies to link information technology (IT) investments to agency accomplishments, and to establish a process to select, manage and control these agency investments. To meet this requirement, the Office of the Chief Information Officer (OCIO) is leading the effort to create an Interior-wide enterprise architecture. Enterprise architecture is an integrated framework and governance process for managing and evolving IT while meeting strategic and information resource management goals. To be successful, the architecture must be derived from business requirements and be understood and supported by IT senior management and the heads of the Bureaus. Information technology does not exist for its own purposes; rather it exists to support the needs of business users. Accordingly, the first major product of the architecture process is the IEA Common Requirements Vision (CRV), published on October 15, 2001. This vision document is intended to ensure that Interior's IT products and services are aligned with the business community's strategic direction. It preceded creation of this document, the IEA Conceptual Architecture Principles (CAP), a logically consistent set of principles that are derived from the business requirements and will be used to guide the engineering of the organizations information systems and technology infrastructure. In essence, the architecture is the DNA necessary for successful growth and development of information technology throughout Interior.

NTIS

Management Information Systems; Resources Management; Deoxyribonucleic Acid

20060005683 Northeastern Forest Experiment Station, Upper Darby, PA, USA

Estimating Maximum Allowable Timber Yields by Linear Programming

Leak, W. B.; January 1964; 14 pp.; In English

Report No.(s): PB2006-102610; FSRP-NE-17; No Copyright; Avail.: CASI: [A03](#), Hardcopy

In forestry, linear programming so far has been used primarily for analyzing economic problems of allocation. The technique has seldom, if ever, been applied to the solution of problems in mensuration, silviculture, or protection, possibly because few foresters are familiar with its use and limitations. However, several common forestry problems appear to be amenable to linear programming. An approach to the solution of one of these problems, the estimation of maximum allowable timber yields, will be described in this paper.

NTIS

Estimating; Linear Programming

20060005695 Government Accountability Office, Washington, DC, USA

DOD Systems Modernization: Planned Investment in the Naval Tactical Command Support System Needs to Be Reassessed

Dec. 2005; 106 pp.; In English

Report No.(s): PB2006-103478; GAO-06-215; No Copyright; Avail.: CASI: [A06](#), Hardcopy

Because it is important that the Department of Defense (DOD) adheres to disciplined information technology (IT) acquisition processes to successfully modernize its business systems, GAO was asked to determine whether the Naval Tactical Command Support System (NTCSS) is being managed according to important aspects of DOD's acquisition policies and guidance, as well as other relevant acquisition management best practices. NTCSS was started in 1995 to help Navy personnel effectively manage ship, submarine, and aircraft support activities. To date, about \$1 billion has been spent to partially deploy NTCSS to about one-half its intended ashore and afloat sites.

NTIS

Commerce; Defense Program; Support Systems

20060005709 Rocky Mountain Research Station, Fort Collins, CO, USA

Spline Model of Climate for the Western USA

Rehfeldt, G. E.; January 2006; 32 pp.; In English

Report No.(s): PB2006-102807; RMRS-GTR-165; No Copyright; Avail.: National Technical Information Service (NTIS)

Monthly climate data of average, minimum, and maximum temperature and precipitation normalized for the period 1961 through 1990 were accumulated from approximately 3,000 weather stations in the Western USA and Southwestern Canada. About two-thirds of these observations were available from the weather services of the two countries while the remaining third were added to the normalized base from daily weather records of stations of short duration. Tests of the procedures used to normalize these supplemental data showed that estimates on average were within 0.2 C for temperature variables and 2.7 mm for precipitation. Applications of the model in plant biology are illustrated for: (1) generating climate estimates for locations specified by latitude, longitude, and elevation, (2) mapping climate variables, (3) separating species distributions in climatic space, and (4) relating genetic variation among populations to climatic gradients.

NTIS

Climate; Climate Models; Splines; United States

20060005712 Rocky Mountain Research Station, Fort Collins, CO, USA

Decision Support Systems for Ecosystem Management: An Evaluation of Existing Systems

January 2000; 164 pp.; In English

Report No.(s): PB2006-102806; RMRS-GTR-296; No Copyright; Avail.: CASI: [A08](#), Hardcopy

This report evaluates 24 computer-aided decision support systems (DSS) that can support management decision-making in forest ecosystems. It compares the scope of each system, spatial capabilities, computational methods, development status, input and output requirements, user support availability, and system performance. Questionnaire responses from the DSS developers (who have sole responsibility for their content) provide the basis for four summary tables comparing system capabilities. The responses are also presented verbatim for reference. This evaluation aids potential users of decision support systems in determining which system most closely fulfills their needs.

NTIS

Computer Techniques; Decision Support Systems; Ecosystems; Geographic Information Systems

20060005719 Kentucky Univ., Lexington, KY USA

Bearing Capacity Analysis and Design of Highway Base Materials Reinforced with Geofabrics

Sun, L.; Slepak, M.; Hopkins, T. C.; Jun. 2005; 142 pp.; In English

Report No.(s): PB2006-101665; KTC-05-21/SPR-238-02-1F; No Copyright; Avail.: CASI: [A07](#), Hardcopy

The primary objective of this study was to develop and implement mathematical bearing capacity models originally proposed by Hopkins (1988, 1991) and Slepak and Hopkins (1993; 1995). These advanced models, which are based on limit equilibrium and are operated together, can be used to analyze the bearing capacity, or stability, of early construction of loads on a single layer of material, two-layered problems involving a layer of base aggregate and subgrade, and a foundation involving multiple layers of different materials, such as a flexible asphalt pavement. A Prandtl-type shear surface is used in the model analyses of layered foundations. In this report, the models are extended to analyzing flexible pavements reinforced with tensile elements. Although the current model does not account for strain compatibility, the strength of the tensile elements may be input for assumed strain levels. Any number of tensile elements may be analyzed in a given problem. In the limit equilibrium approach, shear strengths, the angle of internal friction, ϕ , and cohesion, c , are entered for each layer of material. Triaxial testing of the asphalt material is performed in a manner that the shear strength parameters, ϕ and c , are developed as a function of temperature. Hence, if the temperature of the asphalt layer is known (or assumed) at a site, then values of ϕ , and c , may be calculated from the relationships between the shear strength parameters and temperature. Moreover, to facilitate and

provide an efficient means of analyzing early construction cases and flexible pavements reinforced with geosynthetics, 'Windows' software was developed.

NTIS

Construction; Geotechnical Fabrics; Highways; Pavements

20060006404 Lawrence Livermore National Lab., Livermore, CA USA

Domain-Specific Web Service Discovery with Service Class Descriptions

Rocco, D.; Caverlee, J.; Liu, L.; Critchlow, T. J.; Feb. 15, 2005; 14 pp.; In English

Report No.(s): DE2005-15016847; UCRL-CONF-209717; No Copyright; Avail.: Department of Energy Information Bridge

This paper presents DynaBot, a domain-specific web service discovery system. The core idea of the DynaBot service discovery system is to use domain-specific service class descriptions powered by an intelligent Deep Web crawler. In contrast to current registry-based service discovery systems--like the several available UDDI registries--DynaBot promotes focused crawling of the Deep Web of services and discovers candidate services that are relevant to the domain of interest. It uses intelligent filtering algorithms to match services found by focused crawling with the domain-specific service class descriptions. We demonstrate the capability of DynaBot through the BLAST service discovery scenario and describe our initial experience with DynaBot.

NTIS

Algorithms; Websites

20060006406 Lawrence Livermore National Lab., Livermore, CA USA

Automatic Generation of Data Types for Classification of DeepWeb Sources

Ngu, A. H. H.; Buttler, D. J.; Critchlow, T. J.; Feb. 15, 2005; 14 pp.; In English

Report No.(s): DE2005-15016845; UCRL-CONF-209179; No Copyright; Avail.: Department of Energy Information Bridge

A Service Class Description (SCD) is an effective meta-data based approach for discovering Deep Web sources whose data exhibit some regular patterns. However, it is tedious and error prone to create an SCD description manually. Moreover, a manually created SCD is not adaptive to the frequent changes of Web sources. It requires its creator to identify all the possible input and output types of a service a priori. In many domains, it is impossible to exhaustively list all the possible input and output data types of a source in advance. In this paper, we describe machine learning approaches for automatic generation of the data types of an SCD. We propose two different approaches for learning data types of a class of Web sources. The Brute-Force Learner is able to generate data types that can achieve high recall, but with low precision. The Clustering-based Learner generates data types that have a high precision rate, but with a lower recall rate. We demonstrate the feasibility of these two learning-based solutions for automatic generation of data types for citation Web sources and presented a quantitative evaluation of these two solutions.

NTIS

Classifications; Machine Learning; Domains

20060006444 Lawrence Livermore National Lab., Livermore, CA USA

High Performance Storage System Scalability: Architecture, Implementation, and Experience

Watson, R. W.; Jan. 06, 2005; 22 pp.; In English

Report No.(s): DE2005-15015911; UCRL-PROC-208872; No Copyright; Avail.: Department of Energy Information Bridge

The High Performance Storage System (HPSS) provides scalable hierarchical storage management (HSM), archive, and file system services. Its design, implementation and current dominant use are focused on HSM and archive services. It is also a general-purpose, global, shared, parallel file system, potentially useful in other application domains. When HPSS design and implementation began over a decade ago, scientific computing power and storage capabilities at a site, such as a DOE national laboratory, was measured in a few 10s of gigaops, data archived in HSMs in a few 10s of terabytes at most, data throughput rates to an HSM in a few megabytes/s, and daily throughput with the HSM in a few gigabytes/day. At that time, the DOE national laboratories and IBM HPSS design team recognized that we were headed for a data storage explosion driven by computing power rising to teraops/petaops requiring data stored in HSMs to rise to petabytes and beyond, data transfer rates with the HSM to rise to gigabytes/s and higher, and daily throughput with a HSM in 10s of terabytes/day. This paper discusses HPSS architectural, implementation and deployment experiences that contributed to its success in meeting the above orders of magnitude scaling targets. We also discuss areas that need additional attention as we continue significant scaling into the future.

NTIS

Architecture (Computers); Computer Storage Devices; Computer Systems Performance; Data Storage

COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20060005845

Regional carbon cycle modeling at the Bermuda Atlantic Time-series Study (BATS) using an eddy-resolving model forced by satellite altimetry

November 2005; 9 pp.; Original contains color illustrations

Contract(s)/Grant(s): NAG5-11265; No Copyright; Avail.: CASI: [A02](#), Hardcopy

With the support of a prior grant from NASA as part of the U.S. JGOFS Synthesis and Modeling Program (SMP), an open boundary ocean model was configured in a domain bounded by the four Topex/Poseidon (T/P) ground tracks surrounding the U.S. JGOFS Bermuda Atlantic Time-series (BATS) site. This implementation facilitates prescription of model boundary conditions directly from altimetric measurements (both T/P and European Resource Satellite ERS-2). A regional hindcast simulation has been constructed using altimetric observations during the period October 1992 through September 1998. Results are available in animated form on the web.

Author

Carbon Cycle; Boundary Conditions; Ocean Models; Computerized Simulation

CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also [54](#) *Man/System Technology and Life Support*.

20060005761 West Virginia Univ., Morgantown, WV, USA

Hybrid Neural-Networks Modeling of an Enzymatic Membrane Reactor

Al-Yemni, Mohammed; Yang, Ray Y. K.; Journal of The Chinese Institute of Engineers. Special Issue: Chemical Engineering; Volume 28, No. 7; November 2005, pp. 1061-1068; In English; See also [20060005754](#); Copyright; Avail.: Other Sources

Many complex biochemical and chemical processes are suitable candidates for modeling via artificial neural-networks (ANN); but the black-box approach of ANN may limit the model's ability to extrapolate beyond its training data. In recent years, a major effort has been launched to develop hybrid artificial neural networks (HANN), in which a degree of deterministic first-principle approach is integrated into the black-box ANN to achieve the best of both. In this paper, two HANN models were developed for a steady-state continuous-flow enzymatic tubular membrane reactor used for saccharification of cellulose to glucose and cellobiose. These HANN models were found to perform much better than a pure ANN model with no first-principle component. The improvements were particularly significant when extrapolations beyond the sets of training data were involved. It was also found that, in hybrid neural-networks modeling of a bioreactor, incorporation of fundamental but flexible information on bio-reaction rates beyond mass-balance relations could lead to significant improvement in the performance of a HANN model.

Author

Neural Nets; Enzyme Activity; Membranes; Artificial Intelligence

NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20060005758 Kansas State Univ., Manhattan, KS, USA

Graph-Theoretic Approach for Identifying Catalytic or Metabolic Pathways

Fan, L. T.; Bertok, B.; Friedler, F.; Lee, D.-Y.; Seo, H.; Park, S.; Lee, S. Y.; Journal of The Chinese Institute of Engineers. Special Issue: Chemical Engineering; Volume 28, No. 7; November 2005, pp. 1021-1038; In English; See also [20060005754](#); Copyright; Avail.: Other Sources

Stoichiometrically exact and potentially feasible catalytic or metabolic pathways can be found by synthesizing the networks of plausible elementary or metabolic reactions constituting such pathways, respectively. The current contribution

presents a mathematically exact algorithmic approach for carrying out the necessary synthesis, which is profoundly complex combinatorially. The approach is based on the unique graph-representation in terms of P-graphs (process graphs), a set of axioms, and a group of combinatorial algorithms. The inclusion or exclusion of a step of each elementary or metabolic reaction in the pathway of interest hinges on the general combinatorial properties of feasible reaction networks. At the outset, a brief overview is given of successful applications to date, followed by an outline of the methodology, on which the approach is based. The approach is illustrated by implementing it to three new examples comprising two catalytic reactions, catalytic combustion of hydrogen and reduction of nitrogen oxide, and one metabolic reaction, involved in the production of ethanol by yeast. The efficacy of the approach is discussed in light of the results obtained from these examples. Finally, a brief discourse is given of our current and future efforts.

Author

Metabolism; Algorithms; Combinatorial Analysis; Graph Theory; Graphs (Charts)

65

STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20060005580 Institute of Sound and Vibration Research, Southampton, UK

Bayesian Algorithms for Speech Enhancement

Andrianakis, I; White, P. R.; January 2006; 74 pp.; In English; Original contains black and white illustrations

Report No.(s): ISVR-TR-305; Copyright; Avail.: Other Sources

Bayesian algorithms have been proven very successful in enhancing speech from background noise. A large number of such algorithms can be found in the scientific literature of the past 25 years. In this report a number of frequency domain Bayesian algorithms for speech enhancement is examined and evaluated. The algorithms can be grouped according to the feature of the Short Time Fourier Transform (STFT) they act upon, the estimator applied and the speech prior density function used. The STFT features considered are the DFT coefficients of the STFT (real and imaginary part) and their amplitude. The estimators applied are the Minimum Mean Square Error (MMSE) and the Maximum A Posteriori (MAP). Finally, the priors used are the one and two sided Chi and Gamma probability density functions (PDFs). Of particular interest is the value of the parameter α , which greatly influences the shape of the PDFs and subsequently the performance of the respective algorithms. Results from extensive simulations performed with all the examined algorithms are also presented. The algorithms are evaluated according to two objective measures, the Segmental SNR (SegSNR) and the Perceptual Evaluation of Speech Quality (PESQ). An informal subjective evaluation of the enhanced speech is also given.

Author

Algorithms; Augmentation; Bayes Theorem; Speech Recognition

20060006428 Northeastern Forest Experiment Station, Upper Darby, PA, USA

Comparison of Four Survey Techniques Used in Outdoor Recreation Research

Shafer, E. L.; January 1967; 28 pp.; In English

Report No.(s): PB2006-102635; FSRP-NE-86; No Copyright; Avail.: CASI: [A03](#), Hardcopy

Because of the great and growing interest in outdoor recreation, many studies are being made by private and public agencies that need information for planning use of land and facilities for recreational purposes. In these studies much attention is being given to the people who use recreational facilities-who they are; where they come from; what they like; what they want; how much they are willing to spend. Many types of surveys are being used in studying these people. The main question in planning a survey of this sort is: What survey technique can be used that will provide the most reliable and valid results at the least cost. To get an answer that we could use in our recreation research program, we made a study of four different survey techniques-a personal interview, a handout questionnaire, an immediate mail questionnaire, and a delayed mail questionnaire. Results show that the delayed mail survey, conducted 3 months after the camping experience, gets the best results at the least cost. Our study is described here for the benefit of other research workers in outdoor recreation.

NTIS

Land Management; Land Use; Planning; Recreation; Surveys

SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20060005601 Royal Netherlands Meteorological Inst., Netherlands

Situational Team Design

Post, W. M.; van den Broek, J.; September 2005; 41 pp.; In English; Original contains color illustrations

Report No.(s): TD2005-0089; Copyright; Avail.: Other Sources

When teams are confronted with situations for which they aren't well equipped, they try to make the best of it, for example by working harder, and by tolerating more errors. Unfortunately, teams don't ask themselves whether the original team design is not suited for the situation. The possibilities are investigated to support a real-time reorganization process.

Author

Teams; Tasks; Real Time Operation; Errors

PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics, or 92 Solar Physics*.

20060005656 Fermi National Accelerator Lab., Batavia, IL, USA

Reducing the Longitudinal Emittance of the 8-GeV Beam via the rf Manipulation in a Booster Cycle

Yang, X.; Lebedev, V. A.; Ankenbrandt, C. M.; January 2005; 12 pp.; In English

Report No.(s): DE2005-15020249; FERMILAB-FN-0770; No Copyright; Avail.: Department of Energy Information Bridge

Bunch rotation will cause the longitudinal emittance growth whenever there are far more a rf stations than B rf stations, or vice versa. An alternate method via optimizing the RFSUM curve in a Booster cycle has been investigated using the ESME stimulation.

NTIS

Emittance; Injectors; Radio Frequencies; Rotation

20060005702 Brookhaven National Lab., Upton, NY USA

Beam Halo Formation in High-Intensity Beams

Fedotov, A. V.; January 2005; 14 pp.; In English

Report No.(s): DE2005-15020510; BNL-75045-2005-CP; No Copyright; Avail.: Department of Energy Information Bridge

Studies of beam halo became unavoidable feature of high-intensity machines where uncontrolled beam loss should be kept to extremely small level. For a well controlled stable beam such a loss is typically associated with the low density halo surrounding beam core. In order to minimize uncontrolled beam loss or improve performance of an accelerator, it is very important to understand what are the sources of halo formation in a specific machine of interest. The dominant mechanisms are, in fact, different in linear accelerators, circular machines or Energy Recovering Linacs (ERL). In this paper, we summarize basic mechanisms of halo formation in high-intensity beams and discuss their application to various types of accelerators of interest, such as linacs, rings and ERL.

NTIS

Halos; Beams (Radiation)

20060005703 Brookhaven National Lab., Upton, NY USA

Bunched Beam Stochastic Cooling Project for RHIC

Brennan, J. M.; Blaskiewicz, M. M.; Sep. 2005; 12 pp.; In English

Report No.(s): DE2005-15020511; BNL-75047-2005-CP; No Copyright; Avail.: Department of Energy Information Bridge

The main performance limitation for RHIC is emittance growth caused by IntraBeam Scattering during the store. We have developed a longitudinal bunched-beam stochastic cooling system in the 5-8 GHz band which will be used to counteract IBS longitudinal emittance growth and prevent de-bunching during the store. Solutions to the technical problems of achieving sufficient kicker voltage and overcoming the electronic saturation effects caused by coherent components within the Schottky

spectrum are described. Results from tests with copper ions in RHIC during the FY05 physics run, including the observation of signal suppression, are presented.

NTIS

Cooling; Stochastic Processes

20060005705 Brookhaven National Lab., Upton, NY USA

Detailed Studies of Electron Cooling Friction Force

Fedotov, A. V.; January 2005; 16 pp.; In English

Report No.(s): DE2005-15020509; BNL-75044-2005-CP; No Copyright; Avail.: Department of Energy Information Bridge

High-energy electron cooling for RHIC presents many unique features and challenges. An accurate estimate of the cooling times requires detailed simulation of the electron cooling process. The first step towards such calculations is to have an accurate description of the cooling force. Numerical simulations are being used to explore various features of the friction force which appear due to several effects, including the anisotropy of the electron distribution in velocity space and the effect of a strong solenoidal magnetic field. These aspects are being studied in detail using the VORFAL code, which explicitly resolves close binary collisions. Results are compared with available asymptotic and empirical formulas and also, using the BETACOOOL code, with direct numerical integration of less approximate expressions over the specified electron distribution function.

NTIS

Cooling; Friction

20060005707 Brookhaven National Lab., Upton, NY USA

Measurement of the Secondary Emission Yield of a Thin Diamond Window in Transmission Mode

Chang, X.; Ben-Zvi, I.; Burrill, A.; Hulbert, S.; Jonnson, P.; Oct. 2005; 10 pp.; In English

Report No.(s): DE2005-15020506; BNL-75033-2005-CP; No Copyright; Avail.: Department of Energy Information Bridge

The secondary emission enhanced photoinjector (SEEP) is a promising new approach to the generation of high-current, high-brightness electron beams. A low current primary electron beam with energy of a few thousand electron-volts strikes a specially prepared diamond window which emits secondary electrons with a current two orders of magnitude higher. The secondary electrons are created at the back side of the diamond and drift through the window under the influence of a strong electrical field. A hydrogen termination at the exit surface of the window creates a negative electron affinity (NEA) which allows the electrons to leave the diamond. An experiment was performed to measure the secondary electron yield and other properties. The results are discussed in this paper.

NTIS

Diamonds; Electron Beams; Secondary Emission

20060005708 Brookhaven National Lab., Upton, NY USA

Experimental Benchmarking of the Magnetized Friction Force

Fedotov, A. V.; Litvinenko, V. N.; Oct. 2005; 12 pp.; In English

Report No.(s): DE2005-15020508; BNL-75043-2005-CP; No Copyright; Avail.: Department of Energy Information Bridge

High-energy electron cooling, presently considered as essential tool for several applications in high-energy and nuclear physics, requires accurate description of the friction force. A series of measurements were performed at CELSIUS with the goal to provide accurate data needed for the benchmarking of theories and simulations. Some results of accurate comparison of experimental data with the friction force formulas are presented.

NTIS

Friction; Magnetization; Force

20060005741 Fermi National Accelerator Lab., Batavia, IL, USA

Proposed Transition Scheme for the Longitudinal Emittance Control in the Fermilab Booster

Yang, X.; Ankenbrandt, M.; MasLachlan, J.; Lebedev, V. A.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15020250; FERMILAB-FN-0772; No Copyright; Avail.: Department of Energy Information Bridge

No abstract available

Longitudinal Control; Particle Accelerators

20060005742 Fermi National Accelerator Lab., Batavia, IL, USA

Phase Trombone Program Migration for the Recycler Ring at Fermilab

Xiao, M.; January 2005; 8 pp.; In English

Report No.(s): DE2005-15020166; FERMILAB-CONF-05-100; No Copyright; Avail.: Department of Energy Information Bridge

A best matching algorithm was found using a test program written in Mathematica, and was integrated into an accelerator control on-line program. This on-line program now gets rid of network communication, and does not need to run code MAD. In this report, we first describe the matching conditions, and 4 cases of constraints. Using a test program written in Mathematica, given change of tunes, we were able to find the possible combination of the quadrupole strength in trombone section for each case. We then tested the calculation results by simulations using code MAD and by experiments on the Recycler ring. Finally we found the best matching algorithm and integrated it into an accelerator control on-line program. The test results for the setting and measured tune values by running on-line program on console are also presented.

NTIS

Migration; Particle Accelerators; Quadrupoles

20060005743 Fermi National Accelerator Lab., Batavia, IL, USA

Reducing the Emittance Growth during Transition Crossing via the rf Manipulation and the gamma-t Jump

Yang, X.; Ankenbrandt, C. M.; Lebedev, V. A.; January 2005; 12 pp.; In English

Report No.(s): DE2005-15020248; FERMILAB-FN-0771; No Copyright; Avail.: Department of Energy Information Bridge

No abstract available

Crossings; Emittance; Injectors; Radio Frequencies

20060005744 Fermi National Accelerator Lab., Batavia, IL, USA, Tata Energy Research Inst., Bombay, India

DO Higgs Physics Results

Rani, K. J.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15020161; FERMILAB-CONF-05-228; No Copyright; Avail.: Department of Energy Information Bridge

No abstract available

Higgs Bosons; Standard Model (Particle Physics)

20060005751 Fermi National Accelerator Lab., Batavia, IL, USA

Studies of the Chromaticity, Tune, and Coupling Drift in the Tevatron

Martens, M. A.; Annala, J.; Bauer, P.; Shiltsev, V.; Veley, G.; January 2005; 8 pp.; In English

Report No.(s): DE2005-15020164; FERMILAB-CONF-05-204; No Copyright; Avail.: National Technical Information Service (NTIS)

Chromaticity drift is a well-known and more or less well-understood phenomenon in superconducting colliders such as the Tevatron. Less known is the effect of tune, and coupling drift, also observed in the Tevatron during injection. These effects are caused by field drifts in the superconducting magnets. Controlling the behavior of the tune, coupling, and chromaticity is an important part of reducing beam loss at injection and at the start of the Tevatron ramp.

NTIS

Color; Particle Accelerators; Beam Injection; Superconductivity

20060006327 Brookhaven National Lab., Upton, NY USA

Recent Test Results of the Past-Pulsed 4T Cos Dipole GSI 001

Moritz, G.; Kaugerts, J.; Escallier, J.; Ganetis, G.; Jain, A.; May 2005; 10 pp.; In English

Report No.(s): DE2005-15016817; BNL-74821-2005-CP; No Copyright; Avail.: Department of Energy Information Bridge

For the FAIR-project at GSI a model dipole was built at BNL with the nominal field of 4 T and a nominal ramp rate of 1 T/S. The magnet design was similar to the RHIC dipole, with some changes for loss reduction and better cooling. The magnet was already successfully tested in a vertical cryostat, with good training behavior. Cryogenic losses were measured and first results of field harmonics were published. However, for a better understanding of the cooling process, quench currents

at several ramp rates were investigated. Detailed measurements of the field harmonics at 2 T/S between 0 and 4 T were performed.

NTIS

Dipoles; Accelerators

20060006328 Fermi National Accelerator Lab., Batavia, IL, USA

Electroweak Measurement at CDF

Sidoti, A.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15020160; FERMILAB-CONF-05-218; No Copyright; Avail.: National Technical Information Service (NTIS)

No abstract available

Electroweak Interactions (Field Theory); Particle Accelerators; Proton-Antiproton Interactions

20060006367 Brookhaven National Lab., Upton, NY USA

Helium Flow Induced Orbit Jitter at RHIC

Montag, C.; He, P.; Jia, L.; Nicoletti, A.; Satogata, T.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15016125; BNL-73482; No Copyright; Avail.: Department of Energy Information Bridge

Horizontal beam orbit jitter at frequencies around 10 Hz has been observed in RHIC for several years. The distinct frequencies of this jitter have been found at superconducting low-beta quadrupole triplets around the ring, where they coincide with mechanical modes of the cold masses. Recently, we have identified liquid helium flow as the driving force of these oscillations.

NTIS

Helium; Vibration

20060006369 Brookhaven National Lab., Upton, NY, USA

Single Spin Asymmetries

January 2005; 154 pp.; In English

Report No.(s): DE2005-15016695; BNL-74717; No Copyright; Avail.: Department of Energy Information Bridge

With the RHIC spin program, for the first time, we are able to study single transverse-spin asymmetries (STSA) at collider energies. In this talk, he will concentrate on collinear factorization approach to STSA and its connection to other approaches. One main advantage of this approach is that we can systematically quantify high order corrections because of the extension of factorization theorem to power corrections in hadronic collisions. Within the collinear factorization formalism, STSA are consequences of coherent multiparton interactions characterized by high twist matrix elements, which are as fundamental as better-known parton distributions. The observed rising XF dependence of the asymmetries is a natural result of the short distance dynamics at twist-3 level.

NTIS

Asymmetry; Particle Spin

20060006385 Brookhaven National Lab., Upton, NY, USA

Scientific Presentations 11th Meeting of the Management Steering Committee of the RIKEN BNL Collaboration

May 27, 2005; 282 pp.; In English

Report No.(s): DE2005-15016377; BNL-74679; No Copyright; Avail.: Department of Energy Information Bridge

The RIKEN BNL Research Center (RBRC) was established in April 1997 at Brookhaven National Laboratory. It is funded by the 'Rikagaku Kenkyusho,' (RIKEN) The Institute of Physical and Chemical Research, of Japan. The Center is dedicated to the study of strong interactions, including hard QCD/spin physics, lattice QCD and RHIC (Relativistic Heavy Ion Collider) physics through nurturing of a new generation of young physicists. The first Director of RBRC (1997 - 2003) was Professor T. D. Lee.

NTIS

Heavy Ions; Quantum Chromodynamics

20060006386 Brookhaven National Lab., Upton, NY USA

Harmonic Cavity Performance for NSLS II

Blednykh, A.; Krinsky, S.; Podobedov, B.; Towne, N.; Wang, J. M.; May 2005; 10 pp.; In English

Report No.(s): DE2005-15016289; BNL-74015-2005-CP; No Copyright; Avail.: Department of Energy Information Bridge

NSLS-II is a 3 GeV ultra-high brightness storage ring planned to succeed the present NSLS rings at BNL. Ultra-low emittance combined with short bunch length means that it is critical to minimize the effects of Touschek scattering and coherent instabilities. Improved lifetime and stability can be achieved by including a third-harmonic RF cavity in the baseline design. This paper describes the required harmonic RF parameters and the expected system performance.

NTIS

Cavities; Cavity Resonators; Storage Rings (Particle Accelerators); Synchrotrons

20060006387 Brookhaven National Lab., Upton, NY USA

Model Study of Transverse Mode Coupling Instability at National Synchrotron Light Source-II (NSLS II)

Blednykh, A.; Wang, J. M.; May 2005; 10 pp.; In English

Report No.(s): DE2005-15016288; BNL-74014-2005-CP; No Copyright; Avail.: Department of Energy Information Bridge

The vertical impedances of the preliminary designs of National Synchrotron Light Source II (NSLS-II) Mini Gap Undulators (MGU) are calculated by means of GdfidL code. The Transverse Mode Coupling Instability (TMCI) thresholds corresponding to these impedances are estimated using an analytically solvable model.

NTIS

Coupled Modes; Light Sources; Synchrotrons

20060006388 Brookhaven National Lab., Upton, NY USA

Research and Development of a Variable Polarization Superconducting Undulator at the NSLS

Chouhan, S.; Harder, D.; Rakowsky, G.; Skaritka, J.; Tanabe, T.; May 2005; 10 pp.; In English

Report No.(s): DE2005-15016287; BNL-74005-2205-CP; No Copyright; Avail.: Department of Energy Information Bridge

In this paper a new concept for a planar, superconductive, variable polarization undulator (VPU) is presented. Advantage of this design include: (1) electrical tunability for both right and left circular and elliptical, as well as linear vertical or horizontal, (2) it requires no compensation of unwanted vertical field component and (3) used only simple windings of superconductive wire in an interlaced pattern. The construction of the device is described and compared with a permanent magnet VPU with the same gap and period, as well as with previously published concepts.

NTIS

Superconductivity; Synchrotrons; Wiggler Magnets; Polarization

20060006389 Brookhaven National Lab., Upton, NY USA

High Energy Pulsed Power System for AGS Super Neutrino Focusing Horn

Zhang, W.; Sandberg, J.; Weng, W. T.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15016138; BNL-73500; No Copyright; Avail.: Department of Energy Information Bridge

This paper present a preliminary design of a 300 kA, 2.5 Hz pulsed power system. This system will drive the focusing horn of proposed Brookhaven AGS Neutrino Super Beam Facility for Very Long Baseline Neutrino Oscillation Experiment. The peak output power of the horn pulsed power system will reach Giga-watts, and the upgraded AGS will be capable of delivering 1 MW in beam power.

NTIS

Neutrinos; Oscillations

20060006390 Brookhaven National Lab., Upton, NY USA

Electromigration Issues in High Current Horn

Zhang, W.; Ellavia, S.; Sandberg, J.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15016137; BNL-73499; No Copyright; Avail.: Department of Energy Information Bridge

The secondary particle focusing horn for the AGS neutrino experiment proposal is a high current and high current density device. The peak current of horn is 300 kA. At the smallest area of horn, the current density is near 8 kA/mm(sup 2). At very high current density, a few kA/mm(sup 2), the electromigration phenomena will occur. Momentum transfer between electrons and metal atoms at high current density causes electromigration. The reliability and lifetime of focusing horn can be severely

reduced by electromigration. In this paper, we discuss issues such as device reliability model, incubation time of electromigration, and lifetime of horn.

NTIS

Electromigration; High Current

20060006391 Brookhaven National Lab., Upton, NY USA

Machine Protection System for Concurrent Operation of RHIC and BLIP

Wilinski, M.; Bellavia, S.; Glenn, J. W.; Mausner, L. F.; Unger, K. L.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15016134; BNL-73496; No Copyright; Avail.: Department of Energy Information Bridge

The Brookhaven 200MeV linac is a multipurpose machine used to inject low intensity polarized protons for RHIC (Relativistic Heavy Ion Collider), as well as to inject high intensity protons to BLIP (Brookhaven Linac Isotope Producer), a medical isotope production facility. If high intensity protons were injected to RHIC by mistake, administrative radiation limits could be exceeded or sensitive electronics could be damaged. In the past, the changeover from polarized proton to high intensity proton operation has been a lengthy process, thereby never allowing the two programs to run simultaneously. To remedy this situation and allow concurrent operation of RHIC and BLIP, an active interlock system has been designed to monitor current levels in the AGS using two current transformers with fail safe circuitry and associated electronics to inhibit beam to RHIC if high intensity currents are detected.

NTIS

Linear Accelerators; Protection; Radar Echoes

20060006392 Brookhaven National Lab., Upton, NY USA

Measurement and Optimization of Local Coupling from RHIC BPM Data

Calaga, R.; Abeytunge, S.; Bai, M.; Fischer, W.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15016131; BNL-73492; No Copyright; Avail.: Department of Energy Information Bridge

No abstract available

Optimization; Accelerators

20060006393 Brookhaven National Lab., Upton, NY USA

RHIC BPM System Modifications and Performance

Satogata, T.; Calaga, R.; Cameron, P.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15016129; BNL-73490; No Copyright; Avail.: Department of Energy Information Bridge

The RHIC beam position monitor (BPM) system provides independent average orbit and turn-by-turn (TBT) position measurements. In each ring, there are 162 measurement locations per plane (horizontal and vertical) for a total of 648 BPM planes in the RHIC machine. During 2003 and 2004 shutdowns, BPM processing electronics were moved from the RHIC tunnel to controls alcoves to reduce radiation impact, and the analog signal paths of several dozen modules were modified to eliminate gain-switching relays and improve signal stability. This paper presents results of improved system performance, including stability for interaction region beam-based alignment efforts. We also summarize performance of recently-added DSP profile scan capability, and improved million-turn TBT acquisition channels for 10 Hz triplet vibration, nonlinear dynamics, and echo studies.

NTIS

Beams (Radiation); Accelerators

20060006394 Brookhaven National Lab., Upton, NY USA

Measurement and Correction of Nonlinear Chromaticity in RHIC

Tepikian, S.; Ccameron, P.; Penna, A. D.; Ptitsyn, V.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15016130; BNL-73491; No Copyright; Avail.: Department of Energy Information Bridge

To improve luminosity in RHIC by using smaller (beta), higher order chromatic effects may need to be corrected. Measuring of higher order chromaticities is discussed and compared to a model of RHIC, showing agreement. Assuming round beams, four families of octupoles are used to correct the second order chromaticities while keeping under control the amplitude dependent betatron tune spread in the beams. We show that the octupoles can reduce the second order chromaticity in RHIC, but they have insufficient strength for complete correction.

NTIS

Color; Nonlinearity

20060006395 Brookhaven National Lab., Upton, NY USA
Operations and Performance of RHIC as a Cu-Cu Collider
January 2005; 10 pp.; In English
Report No.(s): DE2005-15016127; BNL-73484; No Copyright; Avail.: Department of Energy Information Bridge
No abstract available
Accelerators; Copper

20060006396 Brookhaven National Lab., Upton, NY USA
Simulation of Resonance Streaming at the eRHIC Electron Storage Ring
Montag, C.; January 2005; 10 pp.; In English
Report No.(s): DE2005-15016117; BNL-73474; No Copyright; Avail.: Department of Energy Information Bridge
To estimate electron beam lifetime and detector background at the future electron-ion collider eRHIC, knowledge of the electron beam halo region is essential. Simulations have been performed to determine the deviation of the transverse beam profile from a Gaussian distribution.
NTIS
Electron Beams; Simulation; Storage Rings (Particle Accelerators)

20060006397 Brookhaven National Lab., Upton, NY USA
IR Optics Measurement with Linear Coupling's Action-Angle Parameterization
Luo, Y.; Bai, M.; Pilat, F.; Satogata, T.; Trbojevic, D.; January 2005; 10 pp.; In English
Report No.(s): DE2005-15016116; BNL-73471; No Copyright; Avail.: Department of Energy Information Bridge
A parameterization of linear coupling in action-angle coordinates is convenient for analytical calculations and interpretation of turn-by-turn (TBT) beam position monitor (BPM) data. We demonstrate how to use this parameterization to extract the twiss and coupling parameters in interaction regions (IRs), using BPMs on each side of the long IR drift region. The example of TBT BPM analysis was acquired at the Relativistic Heavy Ion Collider (RHIC), using an AC dipole to excite a single eigenmode.
NTIS
Beams (Radiation); Couplings; Parameterization

20060006403 Fermi National Accelerator Lab., Batavia, IL, USA
Harmonic Decomposition of Orbit Data for Multipole Analysis
Yang, M. J.; January 2005; 8 pp.; In English
Report No.(s): DE2005-15020157; FERMILAB-CONF-05-179; No Copyright; Avail.: Department of Energy Information Bridge
No abstract available
Decomposition; Multipoles

20060006405 Brookhaven National Lab., Upton, NY USA
Differential Current Measurement in the BNL Energy Recovery Linac Test Facility
Cameron, P.; January 2005; 18 pp.; In English
Report No.(s): DE2005-15020019; BNL-74848; No Copyright; Avail.: Department of Energy Information Bridge
An Energy Recovery Linac (ERL) test facility is presently under construction at BNL. The goal of this test facility is to demonstrate CW operation with an average beam current greater than 100mA, and with greater than 99.95% efficiency of current recovery. This facility will serve as a test bed for the novel high current CW photo-cathode, the superconducting RF cavity with HOM dampers, and the lattice and feedback systems needed to insure the specified beam parameters. It is an important stepping stone for electron cooling in RHIC, and essential to meet the luminosity specifications of RHICII. The expertise and experience gained in this effort might also extend forward into a 10-20GeV ERL for the electron-ion collider eRHIC. We report here on the use of a technique of differential current measurement to monitor the efficiency of current recovery in the test facility, and investigate the possibility of using such a monitor in the machine protection system.
NTIS
Beam Currents; Linear Accelerators; Test Facilities

20060006407 Fermi National Accelerator Lab., Batavia, IL, USA

Searches for FCNC Decays $B(S)(D) \rightarrow g \mu^+ \mu^-$

Herdon, M.; Dec. 2004; 8 pp.; In English

Report No.(s): DE2005-15017221; FERMILAB-CONF-04-391-E; No Copyright; Avail.: Department of Energy Information Bridge

This document explains how to search for the flavor-changing neutral current (FCNC) decays using the upgraded CDF II and DO detectors at the Tevatron pp collider.

NTIS

Particle Accelerators; Neutral Currents

20060006408 Lawrence Livermore National Lab., Livermore, CA USA

Neutron and Charged-Particle Induced Cross Sections for Radiochemistry in the Region of Samarium, Europium and Gadolinium

Hoffman, R. D.; Kelley, K.; Dietrich, R. S.; Bauer, R.; January 2005; 100 pp.; In English

Report No.(s): DE2005-15016844; UCRL-TR-211588; No Copyright; Avail.: National Technical Information Service (NTIS)

We have developed a set of modeled nuclear reaction cross sections for use in radiochemical diagnostics. Systematics for the input parameters required by the Hauser-Feshbach statistical model were developed and used to calculate neutron and proton induced nuclear reaction cross sections in the mass region of samarium, europium and gadolinium (62 (le) Z (le) 64, 82 (le) N (le) 96).

NTIS

Charged Particles; Europium; Gadolinium; Neutron Cross Sections; Neutrons; Radiochemistry; Samarium

20060006409 Fermi National Accelerator Lab., Batavia, IL, USA

Magnetic Instabilities in Nb₃Sn Strands and Cables

Kashikhin, V. V.; Zlobin, A. V.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15017034; FERMILAB-CONF-04-253; No Copyright; Avail.: National Technical Information Service (NTIS)

This paper describes a model for calculation of magnetic instabilities in superconducting wires with transport current and reports results of instability simulations in Nb(sub 3)Sn strands from different manufactures. The effect of magnetic instabilities on the strand and cable performance is presented and a criterion for the maximum effective sub-element size of strands for high field magnets is formulated.

NTIS

Magnets; Stability; Strands

20060006412 Fermi National Accelerator Lab., Batavia, IL, USA

Select Overview of Neutrino Experiments

Stefanski, R.; Nov. 2004; 16 pp.; In English

Report No.(s): DE2005-15017030; FERMILAB-CONF-04-238; No Copyright; Avail.: National Technical Information Service (NTIS)

The relationship between the lepton sector and the quark sector is an interesting source of discourse in the current theoretical climate. Models that might someday supersede the Standard Model typically require quark structure, with implications for the lepton sector. This talk will explore some of the consequences of newer models, in the context of certain neutrino experiments.

NTIS

Neutrinos; Climate

20060006413 Lawrence Livermore National Lab., Livermore, CA USA

Ultrasonic Time-of-Flight Measurements on Binary U-6Nb

Souza, P. R.; Jul. 01, 2005; 28 pp.; In English

Report No.(s): DE2005-15016861; UCRL-TR-213367; No Copyright; Avail.: National Technical Information Service (NTIS)

The author performed contact ultrasonic time-of-flight measurements on three binary U-6 wt-% Nb alloy (U-6Nb) cubes. Using the time-of-flight measurement results, thickness, and density, the Acoustic Velocity, Poisson's Ratio, Shear Modulus, and Modulus of Elasticity are calculated. A detailed data is summarized in the spreadsheets 1-6. The calculated data compares

the material properties of each cube before and after a heat treatment (HT). The time-of-flight measurements were performed using the pulse/echo signal overlap technique discussed in the Review of Ultrasonic Pulse/Echo Signal Overlap Technique section of this report. The measurements were made using both the longitudinal and shear ultrasonic modes and acquired in the X, Y, and Z axes of each cube. Thickness and density measurements on the three cubes were performed by the Manufacturing and Materials Engineering Division, Dimensional Inspection Group. The HT was performed on all three cubes in the Manufacturing and Materials Engineering Division, Heat Treat Shop. The process consisted of 200 degrees C for 2 hours in a vacuum furnace, followed by an argon purge to 25 degrees C.

NTIS

Ultrasonic Radiation; Density Measurement; Shear Properties

20060006431 Brookhaven National Lab., Upton, NY USA

Development of Superconducting Combined Function Magnets for the Proton Transport Line for the J-PARC Neutrino Experiment

Nakamoto, T.; Ajima, Y.; Fujii, Y.; Higashi, N.; Ichikawa, A.; May 2005; 12 pp.; In English

Report No.(s): DE2005-15016815; No Copyright; Avail.: Department of Energy Information Bridge

Superconducting combined function magnets will be utilized for the 50 GeV, 750 kW proton beam line for the J-PARC neutrino experiment. The magnet is designed to provide a dipole field of 2.6 T combined with a quadrupole field of 19 T/m in a coil aperture of 173.4 mm at a nominal current of 7345 A. Two full-scale prototype magnets to verify the magnet performance were successfully developed. The first prototype experienced no training quench during the excitation test and good field quality was confirmed.

NTIS

Magnets; Neutrinos; Protons; Superconducting Magnets

20060006432 Brookhaven National Lab., Upton, NY USA

Beam-Beam Simulations For The eRHIC Electron Ring

Montag, C.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15016124; BNL-73481; No Copyright; Avail.: Department of Energy Information Bridge

To study collisions between polarized electrons and heavy ions or polarized protons at high energy, adding a 10 GeV electron storage ring to the existing RHIC facility is currently under consideration. To achieve high luminosities of several 10^{33} cm⁻² sec⁻¹ range, a vertical beam-beam tuneshift parameter of $(\zeta)_y = 0.08$ is required for the electron beam. Simulation studies are being performed to study the feasibility of this high tuneshift parameter and explore the potential for even higher tuneshifts. Recent results of these studies are presented.

NTIS

Electron Beams; Simulation

20060006433 Brookhaven National Lab., Upton, NY USA

Tomographic Measurement of Longitudinal Emittance Growth Due to Stripping Foils

Montag, C.; Ahrens, L.; Thieberger, P.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15016123; BNL-73480; No Copyright; Avail.: Department of Energy Information Bridge

During beam acceleration in the Brookhaven accelerator complex, heavy ions are stripped of their electrons in several steps. Depending on the properties of the stripping foils, this process results in an increased energy spread and longitudinal emittance growth. A tomographic phase space reconstruction technique has been applied to measure the associated emittance growth for different stripping foil materials.

NTIS

Emittance; Tomography

20060006434 Brookhaven National Lab., Upton, NY USA

Interaction Region Design for the Electron-Ion Collider eRHIC

Montag, C.; Parker, B.; Tepikian, S.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15016121; BNL-73478; No Copyright; Avail.: Department of Energy Information Bridge

To facilitate the study of collisions between 10 GeV polarized electrons and 100 GeV/u heavy ions or 250 GeV polarized protons at luminosities in the 10^{33} cm⁻² sec⁻¹ range (e-p case), adding a 10 GeV electron storage ring to the existing RHIC complex has been proposed. The interaction region of this electron-ion collider eRHIC has to provide the

required low-beta focusing, while simultaneously accommodating the synchrotron radiation fan generated by beam separation close to the interaction point, which is particularly challenging. The latest design status of the eRHIC interaction region will be presented.

NTIS

Storage Rings (Particle Accelerators); Luminosity; Electrons; Collisions

20060006435 Brookhaven National Lab., Upton, NY USA

Fast IR Orbit Feedback at RHIC

Montag, C.; Michnoff, R.; Satogata, T.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15016118; BNL-73475; No Copyright; Avail.: Department of Energy Information Bridge

Mechanical low-(beta) triplet vibrations lead to horizontal jitter of RHIC beams at frequencies around 10 Hz. The resulting beam offsets at the interaction points are considered detrimental to RHIC luminosity performance. To stabilize beam orbits at the interaction points, installation of a fast orbit feedback is foreseen. A prototype of this system is being developed and tested. Recent results will be presented.

NTIS

Beam Interactions; Atomic Energy Levels; Prototypes

20060006436 Brookhaven National Lab., Upton, NY USA

Electron Beam Stability Requirements for Linac-Ring Electron-Ion Colliders

Montag, C.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15016119; BNL-73476; No Copyright; Avail.: Department of Energy Information Bridge

In recent years, linac-ring electron-ion colliders have been proposed at a number of laboratories around the world. While the linac-ring approach overcomes the beam-beam tunes shift limitation on the electron beam, it also introduces noise into the ion beam, via the beam-beam interaction with electron bunches of slightly fluctuating intensity and transverse size. The effect of these fluctuations is studied using a linearized model of the beam-beam interaction. Upper limits for the rms jitter amplitudes of electron beam parameters for various linac-ring electron-ion colliders are presented.

NTIS

Beam Interactions; Electron Beams; Linear Accelerators; Stability; Electron Bunching

20060006437 Brookhaven National Lab., Upton, NY USA

Beam-Beam Simulations for Double-Gaussian Beams

Montag, C.; Malitsky, N.; Ben-Zvi, I.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15016120; BNL-73477; No Copyright; Avail.: Department of Energy Information Bridge

Electron cooling together with intra-beam scattering results in a transverse distribution that can best be described by a sum of two gaussians, one for the high-density core and one for the tails of the distribution. Simulation studies are being performed to understand the beam-beam interaction of these double-gaussian beams. Here we report the effect of low-frequency random tune modulations on diffusion in double-gaussian beams and compare the effects to those in beam-beam interactions with regular gaussian beams and identical tune shift parameters.

NTIS

Beam Interactions; Simulation

20060006438 Brookhaven National Lab., Upton, NY USA

Principle of Global Decoupling with Coupling Angle Modulation

Luo, Y.; Pilta, F.; Peggs, S.; Trbojevic, D.; Roser, T.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15016113; BNL-73469; No Copyright; Avail.: Department of Energy Information Bridge

The global betatron decoupling on the ramp is an important issue for the operation of the Relativistic Heavy Ion Collider (RHIC). A new scheme, coupling angle modulation, was found. By modulating two orthogonal skew quadrupole families, an extra rotating coupling is introduced into the coupled machine. The skew quadrupole modulation frequency is about 0.2Hz for the RHIC ramp, and 0.5Hz at injection and store. The eigentune changes are tracked with a high resolution phase lock loop (PLL) tune measurement system. The global coupling correction strengths are determined by the modulation skew quadrupole strengths at the minimum eigentune split multiplied by a factor k . k is determined by the uncoupled eigentune split and the maximum and the minimum tune split during the skew quadrupole modulation. This decoupling scheme is fast and robust. It had been verified at the RHIC and has been applied for the RHIC global decoupling on the ramp. In this article, the principle

of the coupling angle modulation is presented in detail. Simulation results are also shown.

NTIS

Betatrns; Decoupling; Modulation

20060006439 Brookhaven National Lab., Upton, NY USA

Upgrade of RHIC Vacuum Systems for High Luminosity Operation

Hseuh, H. C.; Mapes, M.; Smart, L. A.; Todd, R.; Weiss, D.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15016110; BNL-73457; No Copyright; Avail.: Department of Energy Information Bridge

With increasing ion beam intensity during recent RHIC operations, rapid pressure rises of several decades were observed at most warm sections and at a few cold sections. The pressure rises are associated with electron multi-pacting, electron stimulated desorption and beam ion induced desorption and have been one of the major intensity and luminosity limiting factors for RHIC. Improvement of the warm sections has been carried out in the last few years. Extensive in-situ bakes, additional UHV pumping and anti-grazing ridges have been implemented. Several hundred meters of NEG coated beam pipes have been installed and activated. Vacuum monitoring and logging were enhanced. Preventive measures, such as pumping before cool down to reduce monolayer condensates, were also taken to suppress the pressure rises in the cold sections. The effectiveness of these measures in reducing the pressure rises during machine studies and during physics runs are discussed and summarized.

NTIS

Ion Beams; Luminosity; Vacuum Systems

20060006440 Brookhaven National Lab., Upton, NY USA

Target and Horn Cooling for the Very Long Baseline Neutrino Experiment

January 2005; 10 pp.; In English

Report No.(s): DE2005-15016106; BNL-73445; No Copyright; Avail.: Department of Energy Information Bridge

Thermodynamic studies have been performed for the beam target and focusing horn system to be used in a very long baseline neutrino oscillation experiment. A 2mm rms beam spot with power deposition of over 18 KW presents challenging material and engineering solutions to this project. Given that the amount of heat transferred by radiation alone from the target to the horn is quite small, the primary mechanism is heat removal by forced convection in the annular space between the target and the horn. The key elements are the operating temperature of the target, the temperature of the cooling fluid and the heat generation rate in the volume of the target that needs to be removed. These working parameters establish the mass flow rate and velocity of the coolant necessary to remove the generated heat. Several cooling options were explored using a carbon-carbon target and aluminum horn. Detailed analysis, trade studies and simulations were performed for cooling the horn and target with gaseous helium as well as water.

NTIS

Cooling; Neutrinos; Oscillations; Targets

20060006441 Brookhaven National Lab., Upton, NY USA

Optics for High Brightness and High Current ERL Project at BNL

Kayran, D.; Ben-Zvi, I.; Calaga, R.; Chang, X. Y.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15016112; BNL-73473; No Copyright; Avail.: Department of Energy Information Bridge

An energy recovery linac (ERL), under development at Brookhaven National Laboratory (1,2), will push ERLs further towards high current and high brightness beams. This R&D ERL will operate in two modes: a high current mode and a high charge mode. In this paper we present a lattice of the machine and PARMELA simulations from the cathode to the beam dump. We discuss the design considerations and present main parameters for various modes of operation.

NTIS

Brightness; High Current; Linear Accelerators

20060006443 Brookhaven National Lab., Upton, NY USA

Global Decoupling on the RHIC Ramp

Luo, Y.; Cameron, P.; DellaPenna, A.; Fishcer, W.; Laster, J.; January 2005; 10 pp.; In English

Report No.(s): DE2005-15016111; BNL-73462; No Copyright; Avail.: Department of Energy Information Bridge

The global betatron decoupling on the ramp is an important issue for the operation of the Relativistic Heavy Ion Collider (RHIC), especially in the RHIC polarized proton (pp) run. To avoid the major betatron and spin resonances on the ramp, the

betatron tunes are constrained. And the rms value of the vertical closed orbit should be smaller than 0.5mm. Both require the global coupling on the ramp to be well corrected. Several ramp decoupling schemes were found and tested at RHIC, like N-turn map decoupling, three-ramp correction, coupling amplitude modulation, and coupling phase modulation. In this article, the principles of these methods are shortly reviewed and compared. Among them, coupling angle modulation is a robust and fast one. It has been applied to the global decoupling in the routine RHIC operation.

NTIS

Betatron; Decoupling; Phase Modulation; Root-Mean-Square Errors; Amplitude Modulation

71 ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

20060006290 Research and Technology Organization, Neuilly-sur-Seine, France

New Directions for Improving Audio Effectiveness

April 2005; 442 pp.; In English; RTO Human Factors and Medicine Panel (HFM) Symposium, 11-13 Apr. 2005, Amersfoort, Netherlands; See also 20060006291 - 20060006321; Original contains color illustrations

Report No.(s): RTO-MP-HFM-123; AC/323(HFM-123)TP/60; Copyright; Avail.: CASI: [C01](#), CD-ROM: [A19](#), Hardcopy

This Symposium was organized to consider the challenges and opportunities offered by new audio technologies, such as active noise reduction systems and new designs for spatial audio displays. The participants included experts in human factors engineering, acoustics, speech and hearing science, audiology, military and occupational health & safety, and end users of the various devices for hearing protection and audio information portrayal. Thirty-two technical papers were scheduled, representing research and development efforts in eight nations. The Symposium convened in Amersfoort in the conference centre, De Eenhorn, from Monday, 11 April to Wednesday, 13 April 2005. Open to citizens from NATO member states and NATO Partnership for Peace (PfP) states, it was capably hosted by participants from the nearby TNO Human Factors Institute, Soesterberg. Dr. Bernd de Graaf (TNO) and Ms. Marjolein Klootwijk (TNO) coordinated the local arrangements. Dr. Adelbert Bronkhorst (TNO) and Dr. Douglas Brungart (US Air Force Research Laboratory) chaired the 9- member Program Committee, assisted by Ms. Danielle Pelat (RTA, Paris). The opening session featured a welcoming address by the Mayor of Amersfoort, Mrs. Albertine van Vliet-Kuipers. Three keynote speakers, Dr. A. Dancer (France), Dr. R. Price (USA), and Cdr. F. Bigot (France) contributed additional context for the technical papers. The Human Factors & Medicine (HFM) Panel coordinates an array of research and development efforts beyond the scope of this Symposium, including topics such as training, selection, health, safety, and survival of military personnel. It is one of seven Panels organized under the NATO Research & Technology Board (RTB). RTB is a component of the cooperative research and information exchange undertaken by NATO's Research and Technology Organization (RTO).

Derived from text

Human Factors Engineering; Ear Protectors; Audiology; Active Control; Acoustics; Noise Reduction; Military Technology; Health; Hearing

20060006291 Centro de Instrucción de Medicina Aeroespacial, Madrid, Spain

Evaluation of Noise Effects in Auditory Function in Spanish Military Pilots

Lorente, J. M.; Puente, B.; Esteban, B.; Rios, F.; Vallejo, P.; Velasco, C.; New Directions for Improving Audio Effectiveness; April 2005, pp. 3-1 - 3-7; In English; See also 20060006290; Original contains color illustrations; Copyright; Avail.:

CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Military pilots are particularly exposed to a wide variety of environmental trends and one of them is the noise produced by the aircraft used for flying duties. In addition to that changes in cabin pressure and vibration can be considered as contributing factors. Adverse effects can be produced under several situations, by self exposing to the noise environment in the flight line or during taxi, take off and cruise operations (1,2,3). Environmental stress can be partially coped by using noise reduction devices, but effectiveness is still far away from procuring a complete protection and devices are still problematic in various aspects (4). Consequently limited effectiveness of speech communication and eventually hearing impairment or loss can be produced

Author

Noise Reduction; Auditory Defects; Vibration; Environment Effects

20060006292 Illinois Univ., Urbana, IL, USA

Evaluation of Acoustic Propagation Paths into the Human Head

O'Brien, William D., Jr.; Liu, Yuhui; New Directions for Improving Audio Effectiveness; April 2005, pp. 15-1 - 15-24; In English; See also 20060006290; Original contains color illustrations

Contract(s)/Grant(s): F49620-02-1-0188; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The overall goal has been to develop an acoustic wave propagation model using well-understood and documented computational techniques that track and quantify an air-borne incident acoustic wave propagated around, into and in the human head. This model serves as a computational tool to elucidate the acoustic wave propagation around, into and in the human head. Specifically, the model determines two features: (1) alternate acoustic propagation paths to the cochlear shell that exist besides the normal air-borne acoustic propagation path (eardrum-ossical path) through the auditory canal and (2) sound pressure amplitude in the cochlear shell (relative to the air-borne sound pressure amplitude) via the alternate propagation paths. A 3D finite-element solid mesh was constructed using a digital image database of an adult male head. Coupled acoustic-mechanical finite-element analysis (FEA) was used to model the wave propagation through the fluid-solid-fluid media. The pressure field in fluid media and the displacement field in solid structures were computed at each time step. Instantaneous acoustic pressure waveforms were recorded at various positions inside and outside of the head model, and propagation trajectories (ray paths) were constructed and evaluated from wavefront normals as a function of frequency and incidence angle. The acoustic loss across the skull was estimated to be approximately 33 dB, consistent with theoretical estimates. The computational ray-path results and the theoretical solutions calculated using Snell's law gave a 0.7 difference for low-angle incidence; 10 difference was obtained for larger angle incidence.

Author

Acoustic Propagation; Sound Transmission; Wave Propagation; Acoustic Measurement; Displacement; Eardrums; Skull; Pressure Distribution

20060006294 Institut Franco-Allemand de Recherches, Saint-Louis, France

Noise: A Limiting Factor for the Use of Modern Weapon Systems?

Dancer, A.; Buck, K.; New Directions for Improving Audio Effectiveness; April 2005, pp. KN1-1 - KN1-13; In English; See also 20060006290; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy;

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Continuous and/or impulse noises produced by modern weapon systems constitute a threat for the health of the soldier and impede his operational ability. Moreover, their levels often exceed the statutory exposure limits as well for the users (unprotected and protected ears) as for the nearby community.

Author

Continuous Noise; Weapon Systems; Exposure; Hearing; Damage; Ear

20060006295 Army Aeromedical Research Lab., Fort Rucker, AL, USA

Speech Intelligibility with Acoustic and Contact Microphones

Acker-Mills, Barbara; Houtsma, Adrianus; Ahroon, William; New Directions for Improving Audio Effectiveness; April 2005, pp. 7-1 - 7-14; In English; See also 20060006290; Original contains black and white illustrations; Copyright; Avail.:

CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Speech intelligibility of signals obtained with an acoustic microphone and three types of vibration-driven contact microphones was assessed using the Diagnostic Rhyme Test (DRT). Stimulus words were recorded digitally in a reverberant chamber with no noise and with ambient broadband noise intensity at 106 dB(A). Listeners completed the DRT task in the same settings, thus simulating typical environments of a rotary-wing aircraft. Results show that speech intelligibility is significantly worse for the contact microphones than for the acoustic microphone, particularly in noisy environments, and some consonant types are affected more than others. Therefore, contact microphones are not recommended for use in any situation where fast and accurate speech intelligibility is essential.

Author

Words (Language); Intelligibility; Noise Intensity; Microphones; Broadband; Noise (Sound)

20060006296 Director of Institute for Human Factors TNO, Soesterberg, Netherlands

Evaluation of Speech Synthesis Systems using the Speech Reception Threshold Methodology

vanLeewen, David A.; vanBalken, Johan; New Directions for Improving Audio Effectiveness; April 2005, pp. 9-1 - 9-6; In English; See also 20060006290; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy;

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The intelligibility of speech synthesis systems that are available nowadays is usually high enough to enable comparisons between different synthesis systems based on the speech quality. However, in some situations, like a civil aircraft cockpit, the acoustic environment may be such that intelligibility is a discriminating factor between systems. In this paper we propose a methodology for comparing speech synthesis systems based on the Speech Reception Threshold (SRT). With this method the signal-to-noise ratio is found at which 50% intelligibility of redundant sentences is reached. A system with a lower SRT value is said to be more robust against masking noise. We have compared 5 commercial speech synthesis systems (4 male voices, 5 female voices) in an SRT experiment using a masking noise that was spectrally equivalent to cockpit noise. SRT values range from -4.1dB to 1.1dB. An ANOVA revealed that two of the nine systems had a significantly lower SRT than the rest. There was also an effect of the test subject, which is remarkable because the SRT has usually small variability over listeners.

Author

Intelligibility; Speech; Signal to Noise Ratios; Civil Aviation; Analysis of Variance; Acoustics

20060006297 QinetiQ Ltd., Hants, UK

Experimentation to Address Appropriate Test Techniques for Measuring the Attenuation Provided by Double ANR Hearing Protectors

Mercy, Susan E.; Tubb, Christopher; James, Soo H.; New Directions for Improving Audio Effectiveness; April 2005, pp. 18-1 - 18-13; In English; See also 20060006290; Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Increasingly the military environment can involve exposure to high levels of noise; levels of up to 150dB are anticipated (in some quarters) for deck-crew and ground-crew working with the Joint Combat Aircraft. In order to protect the hearing of personnel in high levels of noise, the use of double protection (earplugs worn in conjunction with earmuffs) is also increasing. Active Noise Reduction (ANR) systems are now widely incorporated into headsets and have also been incorporated into personally moulded earplugs. Therefore, the combination of an ANR Headset and ANR earplugs is the next obvious step in reducing high levels of noise at ear. Difficulties arise in determining the appropriate technique for establishing levels of sound attenuation achieved by the use of this Double ANR system. The Real Ear At Threshold (REAT) method has the advantage that it is a measure of the noise perceived by the subject. However, it can result in masking errors at low frequencies due to physiological noise. REAT cannot be used with ANR devices since the electronic noise of the ANR circuitry at approximately 1-2kHz will raise perceived threshold at this frequency range. The Microphone In Real Ear (MIRE) method has the advantage that it measures the absolute sound pressure levels in the ear canal and can be used with ANR devices. However, this technique does not necessarily measure what the subject hears, as it cannot measure the sound transmitted to the inner ear via routes other than the primary path of the ear canal. The personally moulded earplugs used by QinetiQ have been designed to incorporate microphones at the tip to measure the sound pressure level within the ear canal, and the sense microphone of the ANR earplugs can also be used to measure the sound pressure level within the device. Experiments using ANR headsets in conjunction with passive personally moulded earplugs were used to compare REAT and MIRE methods and to show the differences between the techniques. The experimental results show that the overall attenuation provided by combinations of ANR headsets and passive earplugs can be found by choosing the appropriate technique in any given one third-octave band to produce a combined REAT/MIRE assessment of the attenuation.

Author

Acoustic Attenuation; Ear Protectors; Earphones; Sound Pressure; Hearing; Low Frequencies; Noise Reduction; Active Control

20060006298 Institute for Human Factors TNO, Soesterberg, Netherlands

Auditory Tests for the Early Detection of Noise-Susceptible Individuals: A Literature Study

Vos, Joos; New Directions for Improving Audio Effectiveness; April 2005, pp. 5-1 - 5-6; In English; See also 20060006290; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As a result of noisy military systems and the limited applicability of personal hearing protection, there continues to be a high incidence of noise-induced hearing loss (NIHL) among military personnel. One of the ways to reduce the adverse effects of noise, such as a decreased hearing acuity and a noticeable reduction in the ability to understand speech in noisy conditions, might be the selection of persons who are less susceptible to noise. The Netherlands Ministry of Defense contracted TNO Human Factors to investigate whether at present reliable auditory tests are available to determine in an early stage, i.e. prior to being affected by significant hearing losses, to what extent an individual is susceptible to noise.

Derived from text

Auditory Defects; Human Factors Engineering; Hearing; Acuity; Detection; Ear Protectors

20060006299 TNO Telecom, Delft, Netherlands

Extension of ITU-T Recommendation P.862 PESQ towards Measuring Speech Intelligibility with Vocoders

Beerends, John G.; vanWijngaarden, Sander; vanBuuren, Ronald; New Directions for Improving Audio Effectiveness; April 2005, pp. 10-1 - 10-6; In English; See also 20060006290; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ITU-T recommendation P.862 PESQ was developed for assessing speech quality. The basic idea in PESQ is to compare a reference speech signal with the degraded signal through a psycho-acoustic model and a model of human quality comparison (cognitive model). Within NATO, testing of low bit rate speech codecs is more focused on speech intelligibility than on speech quality. Although the cognitive model of PESQ was designed to represent the quality judging process, it was already found that, for specific applications, PESQ can also predict intelligibility. In this paper PESQ is validated for assessing speech intelligibility with low bit rate vocoders. The results show that improvements in PESQ are necessary in order to obtain high correlations between objective and subjective intelligibility scores.

Author

Speech; Intelligibility; Acoustics; Correlation; Vocoders

20060006300 Air Force Research Lab., Wright-Patterson AFB, OH, USA

Improved Hearing Protection for Aviation Personnel

McKinley, Richard L.; Bjorn, Valerie S.; Hall, John Allen; New Directions for Improving Audio Effectiveness; April 2005, pp. 13-1 - 13-12; In English; See also 20060006290; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Hearing loss has long been associated with the operation of aircraft. Some of the first hearing protectors were developed for use around military aircraft. Today's high performance military aircraft generate noises which typically range from 110 dB to 150 dB. Normally, the source of the noise cannot be quieted without loss in performance. Therefore hearing protection is the primary tool to mitigate aviation personnel noise exposures during operations of aircraft. This paper describes a joint U.S. Air Force and U.S. Navy approach to improve hearing protection and reduce hearing loss risk. The approach included research and development to improve hearing protection as well as technologies to allow personnel to be moved from high noise work areas; recommendations for administrative controls; and investigation of hearing protective pharmaceuticals. The development of improved passive and active hearing protection technologies employed a three phased approach with attenuation performance goals for near-term (35-40 dB), mid-term (40-45 dB), and long-term (45-50+ dB) solutions. The technologies which have been developed to achieve the first two hearing protection goals will be described along with their attenuation performance characteristics. Ongoing research to achieve the long term (45-50+ dB) goal will be described with considerations of bone conducted noise pathways.

Author

Hearing; Ear Protectors; Auditory Defects; Flying Personnel

20060006301 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Soesterberg, Netherlands

Design and Evaluation of Warning Sounds in Frigate Control Centres

vanBalken, Johan S.; vanWijngaarden, Sander J.; New Directions for Improving Audio Effectiveness; April 2005, pp. 24-1 - 24-7; In English; See also 20060006290; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In the ship control centre of the Air Defence and Command Frigates of the Royal Netherlands Navy, auditory warnings are used to indicate critical system conditions and dangerous situations. By means of subjective experiments, the suitability of the applied auditory warnings was assessed, and possible improvements were evaluated. It appeared that for one of the most urgent warning conditions (platform alarm) a less suitable auditory signal was applied, the perceived urgency of which is relatively low, while it is also easily confused with other signals. A straightforward way to modify the perceived urgency (through manipulation of the signal inter-onset interval) was derived from the experimental results.

Author

Warning Systems; Auditory Signals; Ships; Design Analysis

20060006302 AM3D A/S, Aalborg, Denmark

Localization Performance of Real and Virtual Sound Sources

Pedersen, Jan Abildgaard; Jorgensen, Torben; New Directions for Improving Audio Effectiveness; April 2005, pp. 29-1 -

29-30; In English; See also 20060006290; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper describes how a 3D-Audio system for use in fighter aircrafts was evaluated in an experiment, by comparing localization performance between real and virtual sound sources. Virtual sound sources from 58 selected directions were evaluated, while 16 of these directions were also evaluated using real sound sources, i.e. loudspeakers. 13 pilots from the Royal Danish Air Force and 13 civil persons were used in the test. The localization performance was split into a constant and a stochastic difference between the perceived direction and the desired direction (stimulus). The constant difference is a localization offset and the stochastic difference is a measure for the localization uncertainty. Stimuli length of both 250 ms and 2 s enabled investigation of the importance of head movements, i.e. using head tracking. Real and virtual sound sources could be located with an uncertainty of 10° and 14° degrees for azimuth while the uncertainty for elevation was 12° and 24° (real and virtual sound sources). No significant localization offset was found for azimuth, while an average offset for elevation of 30-60 degrees was found using long stimuli. A significant difference between the localization offset obtained in different directions was found especially for elevation, where the offset was found to have a strong correlation to the stimuli elevation.

Author

Sound Localization; Loudspeakers; Azimuth; Fighter Aircraft

20060006303 Air Force Research Lab., Wright-Patterson AFB, OH, USA

Military Speech Communications over Vocoders in Tandem

Ericson, Mark A.; Simpson, Brian D.; McKinley, Richard L.; New Directions for Improving Audio Effectiveness; April 2005, pp. 11-1 - 11-8; In English; See also 20060006290; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

There are two general classes of vocoders used in military communication systems today; these are parametric and waveform vocoders. Waveform vocoding techniques, such as continuous variable slope delta (CVSD), are highly resistant to noise and bit error effects [1, 2]. Parametric encoders, such as advanced multi-band excitation (AMBE) [3], greatly reduce signal bandwidth, which is helpful in reducing encryption processing requirements and the cost of transmitting a wide band signal. Both waveform and parametric vocoders can provide good speech intelligibility alone at adequate bandwidths [4]. However, a 'staging' or 'tandem' problem occurs when waveform encoders and parametric encoders are placed in sequence in a given communication system [5]. The distortion of the speech waveform produced by the first vocoder causes the second vocoder to severely distort the speech waveform, thereby reducing the overall intelligibility. Vocoder algorithms have typically been developed to reduce bandwidth for long distance or secure communications [6, 7]. These devices are not necessarily designed to be compatible in conjunction with other types of vocoders. Military communication systems are likely to have legacy equipment, which will include parametric [7] and waveform types of vocoders [8]. In future military operations, speech communications are likely to occur among more operators from multiple points in the chain of command.

Derived from text

Vocoders; Intelligibility; Military Operations; Telecommunication; Cryptography; Bandwidth; Coders

20060006304 Creare, Inc., Hanover, NH, USA

Hearing Protection for Bone-Conducted Sound

Dietz, Anthony J.; May, B. Scott; Knaus, Darin A.; Greeley, Harold P.; New Directions for Improving Audio Effectiveness; April 2005, pp. 14-1 - 14-17; In English; See also 20060006290; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The high-noise environments in and around modern military jet aircraft can impair voice communications and cause permanent damage to the hearing of pilots and maintenance crews if adequate hearing protection is not worn. With external noise levels of some aircraft approaching 150 dBA, adequate hearing protection must provide better than 50 dB of attenuation. In order to reach such a high level of attenuation, sound transmission routes that bypass the ear canal must be attenuated in addition to the ear canal transmission routes. These bone- and tissue-conduction paths limit the maximum attenuation that can be achieved, even if all air-conducted sound in the ear canal were eliminated. An investigation of bypass sound transmission mechanisms is presented. The aim of this investigation was to characterise the transmission levels of bypass sound to the cochlea and to determine the effectiveness of different hearing protection components in attenuating this sound. Measurements were made with a head simulator as well as with human subjects. In order to make detailed measurements of the vibration of skull bones in an intense sound field, we developed a head simulator. The simulator was built from a human skull, with silicon gel used to model internal organs and silicon and latex used to model the skin. Accelerometers attached to the skull bones were used to measure the skull vibration response. Mechanical point impedance measurements on the simulator were compared to results reported in the literature for humans, cadavers, and skulls. Reasonable agreement with these results served

to validate the simulation. The relationship between skull vibration measured on the skull simulator and bone-conducted sound at the cochlea of a human subject was determined by comparing mechanical point impedance measurements recorded from the skull simulator and from human subjects, with the latter including psycho-acoustic responses. The effect of different hearing protection components on skull vibration and on the attenuation perceived by human subjects was also measured. Finally, the attenuation limits for bypass sound routes through the head and through the torso were determined. The response of the head simulator in a sound field peaked in the 1 to 3 kHz frequency range, which is where the bone-conducted limit to hearing protection attenuation is at a minimum. The bypass sound levels measured on human subjects also increased in this frequency range. The performance of different hearing protection components including ear muffs, helmets, goggles, and face shields was measured on the head simulator and on human subjects, and the results are reported. General guidance concerning the design of devices for providing protection against bypass sound transmission is given. Finally, the need for additional protection of the torso is discussed.

Author

Sound Transmission; Hearing; Voice Communication; Noise Intensity; Impedance Measurement

20060006305 Dartmouth Coll., Hanover, NH, USA

Hybrid Feedforward-Feedback Active Noise Control for Hearing Protection and Communication

Ray, Laura E.; Solbeck, Jason A.; Collier, Robert D.; New Directions for Improving Audio Effectiveness; April 2005, pp. 16-1 - 16-10; In English; See also 20060006290; Original contains color and black and white illustrations; Copyright; Avail.:

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Research over the past decade has demonstrated substantial increases in noise reduction performance for circumaural hearing protectors through feedforward active noise reduction (ANR) based on least mean square (LMS) methods. However, commercialization of feedforward ANR hearing protection devices has yet to occur. This paper explores issues related to robust realization of feedforward ANR for hearing protection. Specifically, the dynamic range of noise sources, the potential for leakage around circumaural earcups, vibration conditions of high noise environments, and the need for communication requires ANR algorithms that are robust to large variations in the acoustical dynamics of hearing protectors. To meet this need, a hybrid ANR architecture that exhibits excellent stability margins and performance for both stationary and non-stationary noise sources is presented. The hybrid system is comprised of a Lyapunov-tuned leaky LMS feedforward component and a broadband digital feedback ANR system. The contribution of each component to ANR performance is adjusted by individual feedforward and feedback gain factors, and stability margins are defined by the net increase in these gains that can be accommodated while maintaining system stability. Stability and noise reduction performance of the hybrid system are validated experimentally using an earcup from a commercial circumaural hearing protector and using a prototype active earplug. Experiments are performed through flat plate or manikin testing using a DSP development system. Results demonstrate that stability margins are increased, in some cases, by several orders of magnitude.

Author

Ear Protectors; Noise Reduction; Active Control; Feedback Control

20060006306 Arnold Engineering Development Center, Arnold AFS, TN, USA

U.S. Navy Flight Deck Hearing Protection Use Trends: Survey Results

Bjorn, Valerie S.; Alberty, Christopher B.; Shilling, Russell; McKinley, Richard L.; New Directions for Improving Audio Effectiveness; April 2005, pp. 1-1 - 1-20; In English; See also 20060006290; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Hearing loss claims have risen steadily in the U.S. Department of Veterans Affairs across all military services for decades. The U.S. Navy, with U.S. Air Force and industry partners, is working to improve hearing protection and speech intelligibility for aircraft carrier flight deck crews who work up to 16 hours per day in 130-150 dB tactical jet aircraft noise. Currently, flight deck crews are required to wear double hearing protection: earplugs and earmuffs (in cranial helmet). Previous studies indicated this double hearing protection provides approximately 30 dB of noise attenuation when earplugs are inserted correctly and the cranial/earmuffs are well-fit and in good condition. To assess hearing protection practices and estimate noise attenuation levels for active duty flight deck crews, Naval Air Systems Command surveyed 301 U.S. Navy Atlantic and Pacific Fleet flight deck personnel from four aircraft carriers and two amphibious assault ships. The survey included a detailed assessment of cranial helmet fit and maintenance condition (e.g., earmuff headband tension, earcup foam and cushion integrity); earplug use and insertion depth; anthropometric measures; and personal/historical data. Data analysis showed that 79% of surveyed flight deck personnel ears received an estimated 0-6 dB of noise attenuation from either shallow earplug insertion depths or never wearing earplugs (47% reported never wearing earplugs). For subjects who reported they sometimes

or always wore earplugs (14% reported always wearing earplugs), only 7% inserted the earplugs deeply enough in both ears to achieve the maximum expected noise attenuation of 22 dB in both ears. Worn without earplugs, the cranial helmet with earmuffs has been reported to provide approximately 21 dB of noise attenuation when correctly fit, worn, and maintained. All survey subjects reported wearing a cranial helmet with earmuffs, but 75% of subjects were issued a questionable size (most wore the largest of four sizes available), and 41% of earcup cushions and foam inserts were deteriorated, hard, creased, or missing. This survey identified numerous technological and hearing conservation policy changes to improve hearing protection for flight deck crews. Based on these findings, the U.S. Navy is improving procedural documentation for flight deck hearing protection fit, use, and maintenance, as well as developing and fielding enhanced hearing protection technology in joint efforts with the U.S. Air Force.

Author

Noise Reduction; Hearing; Ear Protectors; Jet Aircraft Noise; Auditory Defects

20060006307 Defence Research and Development Canada, Toronto, Ontario, Canada

Noise-Induced Hearing Loss in Canadian Military Personnel

Abel, Sharon M.; New Directions for Improving Audio Effectiveness; April 2005, pp. 2-1 - 2-23; In English; See also 20060006290; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The escalating cost of claims for noise-induced hearing loss in the Canadian Forces (CF) prompted the review of current hearing conservation practices. As a first step, a prospective study was conducted to assess risk factors for the development of hearing loss in a wide range of military trades. A total of 1,057 individuals working in land, sea and air environments at five CF military bases contributed their current hearing test results and first hearing test results on record. They also completed a 56-item questionnaire relating to demographics, occupational and non occupational noise exposure history, training in and utilization of personal hearing protection, and risk factors other than noise which might affect hearing, including head injury, ear disease, medications, and solvent exposure. Military medical personnel recruited the subjects, distributed the questionnaires and assessed hearing. Apparatus and protocols for the latter conformed to current clinical practice. The results showed that the prevalence of moderate to severe hearing loss progressed with years of noise exposure, with hearing thresholds in those over 45 years ranging broadly from normal to over 70 dB HL. Unprotected exposure to solvents and leisure noise appeared to be significant determinates of adverse outcome, while the effects of head injury, history of ear disease, and the use of medications were minimal. The survey suggested that training on the hazards of noise exposure and the selection and utilization of hearing protection were inadequate. Hearing protection was reported to be incompatible with other gear, uncomfortable and an impediment to communication.

Author

Auditory Defects; Hearing; Risk; Military Personnel; Hazards; Ear Protectors

20060006308 Hopital d'instruction des Armees Desgenettes, Lyons, France

Distortion Products Otoacoustic Emissions as Markers of Tinnitus Persistence after Acute Acoustic Trauma

Jean-Bertrand, Nottet; Benoit, Suc; Nicolas, Brossard; Agnes, Job; New Directions for Improving Audio Effectiveness; April 2005, pp. 4-1 - 4-12; In English; See also 20060006290; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

It is a common thought in the physicians military community that persistence of tinnitus after acute acoustic trauma (AAT) essentially depends on severity of hearing thresholds shifts. Nevertheless it has never been demonstrated scientifically. Here we have looked for predictive factors of tinnitus duration after AAT by using hearing thresholds and distortion product otoacoustic emissions (DPOAEs). DPOAEs are otoacoustic emissions that revealed the functional state of the active cochlear mechanical processes. Young military adults under 25 years old, without history of tinnitus and hospitalized for an AAT were followed-up for 15 days. Examination during which the tinnitus state was recorded were carried out at three periods of time : 24+/-5 hours, 72 hours and 15 days after the trauma. Two groups were defined according to their tinnitus duration after AAT (Group 1 \h 72 hours and Group 2 \g 72 hours). At 24 hours after AAT, hearing levels in the high frequency range did not differ significantly ($p=0.250$) between the short-lasting tinnitus group (Group 1) and the long-lasting tinnitus group (Group 2). In contrast, 24 hours after AAT, groups differed for DPOAEs, significantly ($p=0.016$). When statistical analyses took into account the severity of the acoustic trauma (Hearing levels held constant), DPOAEs were even more significantly different between the long and short-lasting groups ($p=0.007$). This result is mainly in favour of an outer hair cell (OHC) dysfunction in persistent tinnitus. Here we show that even moderated acoustic trauma could generated persistent tinnitus and was associated with poorer hearing thresholds recovery 15 days after AAT. DPOAEs may be useful predictors at 24 hours after

the trauma, but also certainly before any deleterious acoustic event. Prospective studies are in progress. They could be interesting markers for subsequent pharmacological studies.

Author

Acoustic Measurement; Distortion; Sound Pressure; Statistical Analysis; Hearing

20060006309 Connecticut Univ., Farmington, CT, USA

Improving the Effectiveness of Communication Headsets with Active Noise Reduction: Influence of Control Structure

Brammer, Anthony J.; Peterson, Conald R.; Cherniack, Martin G.; Gullapalli, Subhash; New Directions for Improving Audio Effectiveness; April 2005, pp. 6-1 - 6-8; In English; See also 20060006290; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

For communication headsets equipped with active noise reduction (ANR), the performance of the control system may influence the communication signal reaching the ear. Conversely, the communication signal may perturb the operation of the ANR system. The interaction between the communication and control signals depends primarily on the control structure, and on the bandwidths and frequency responses of the signal channels. The effects are described for two circumaural communication headsets with similar passive, and active, noise reductions, one with an analog feedback control system and the other an adaptive digital feedforward control system. Measurements were conducted in a diffuse sound field, with the headsets mounted on a head and torso simulator. The frequency response of sound reproduced by the communication channel was measured when the ANR system was not operating, and when the control system was operating, with swept pure-tones, and broadband noise. The speech intelligibility was estimated for environmental noise shaped to represent the spectrum of speech, the noise within a tank, or the noise within an aircraft cockpit, by the Speech Transmission Index (STI). The STI and fidelity of sound reproduced by the communication channel of the device with a feed-forward control structure tended to exceed that of the more common feedback control structure. This appeared to be a consequence of the compromised frequency response of the earphone and drive electronics employed in the feedback control system to maintain stability of the feedback loop, as well as the presence of communication sounds sensed by the control microphone that were fed back into the controller. The lack of corruption of the communication signal by the feed-forward control system, together with the possibility of using electro-acoustic components with flat frequency responses, suggests that this control structure may be more consistent with the audio fidelity requirements of advanced auditory communication systems.

Author

Noise Reduction; Earphones; Feedback Control; Voice Communication; Telecommunication; Sound Transmission; Frequency Response; Feed Systems; Channels (Data Transmission)

20060006310 Centre d'Enseignement et de Recherches de Medecine Aeronautique, Bretigny, France

Speech Intelligibility with a Bone Vibrator

Pellieux, L.; Bouy, J. C.; Blancard, C.; Guillaume, A.; New Directions for Improving Audio Effectiveness; April 2005, pp. 8-1 - 8-; In English; See also 20060006290; Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The FELIN project (Foot soldier with Integrated Equipment and Connectivity) of the French DGA (Delegation Generale a' l' Armement - French Military Procurement Agency) aims at gearing tomorrow's foot soldier with a 'flexible and manoeuvring' equipment. Among requirements, the foot soldier will have to be fitted with a communications headband operating through bone conduction. The main advantage of listening through bone conduction is that it allows for the transmission of information to the soldier, while leaving the soldier's ears free to perceive the surrounding environment and use sound cues for orientation in space. Furthermore, this device is light, not bulky and quite comfortable. The laboratory assessment performed aimed at comparing voice intelligibility scores of a prototype bone conduction device with the scores obtained by Peltor's militarized COMTAC-type headset. This latter device is a hearing device, i.e. fitted with two microphones, left and right, to reproduce a spatial hearing capability. It is thus possible to compare these two technologies, which both allow for orientation in space using acoustic cues. Tests were performed in silence and in operationally realistic noise conditions (reproducing the noisy environment inside an armoured vehicle). Voice material is made of nonsense CVC words (Consonant - Vowel - Consonant), spoken by two speakers of different genders. In silence, the prototype bone vibrator headband and the COMTAC headset obtain the same intelligibility score. In noise, the performance of the prototype headband is slightly lower than that of the COMTAC headset. A number of reasons can explain this: 1) in a noisy environment, finding the right position for the vibrator to get optimal hearing conditions is hard to find. 2) the voice transmission level is too low. It seems that the transmission level is limited because of parasite vibrations which start occurring at high levels. As a conclusion, bone conduction technology (limited here to 'listening') provides a significant positive potential, based on the

performance obtained in silence. However, some design improvements must be made to reach levels allowing for intelligibility in noisy environments (notably for use in armoured vehicles).

Author

Vibration; Intelligibility; Words (Language); Data Transmission; Earphones; Hearing; Microphones; Speech

20060006311 Institute for Human Factors TNO, Soesterberg, Netherlands

Objective Measurement of the Speech Transmission Quality of Vocoders by Means of the Speech Transmission Index

vanGils, Bastiaan, J. C. M.; vanWijngaaren, Sander .; New Directions for Improving Audio Effectiveness; April 2005, pp. 12-1 - 12-6; In English; See also 20060006290; Original contains black and white illustrations; Copyright; Avail.:

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Nearly all types of military speech communication involve the use of so-called (narrow band) voice coders or vocoders. Usually the Speech Transmission Index (STI) uses artificial test signals, which can not be reproduced by vocoders with the usual fidelity. Therefore the STI is not able to evaluate vocoders at this time. Although it is theoretically feasible to measure the Speech Transmission Index with natural speech instead of the usual artificial test signals, each of the various speech-based STI measurement methods proposed in the literature has its own shortcomings and inaccuracies. A new procedure is proposed for estimating a speech based modulation transfer function (MTF), on which the STI is based, that approaches the accuracy of conventional STI implementations based on artificial signals. The new method enables evaluation of vocoders by means of the STI. Applying the method to a voice coder database shows promising results, giving an average squared correlation coefficient R^2 of 0.87 between the subjective CVC scores and the calculated STI for male speech.

Author

Correlation Coefficients; Modulation Transfer Function; Vocoders; Estimating

20060006312 QinetiQ Ltd., Hampshire, UK

Investigating Double Hearing Protection using Human Subjects

Tubb, Christopher; Mercy, Susan; James, Soo; New Directions for Improving Audio Effectiveness; April 2005, pp. 19-1 - 19-12; In English; See also 20060006290; Original contains color and black and white illustrations; Copyright; Avail.:

CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In the increasingly noisy military environment and with the growing need to protect the hearing of military personnel, the use of double protection, earplugs and earmuffs used in combination, has become more and more prevalent. Furthermore Active Noise Reduction (ANR) headsets and earplugs appear to offer a means of increasing the attenuation of these double protection systems. However, it has been shown that the attenuation afforded by double protection is not a simple additive process, the combined attenuation tends to be less than the sum of the individual earplug and earmuff attenuation figures. Also, at the levels of attenuation provided by double protection, bone conduction pathways start to play an important part in the sound level received at the ear. A fuller understanding of these processes is required if the full benefit of double protection is to be achieved in future devices. Most previous assessments of the attenuation the afforded by double protection and bone conduction limits have been carried out using the REAT (Real Ear At Threshold) test technique. However, this technique is limited for predicting the attenuation from active systems due to the masking effect of the residual electronic noise. Other work has used ATF (Acoustical Test Fixtures) for predicting the attenuation provided by ANR double protection. However, this can only take into account bone conducted noise by the use of mathematical models. The study presented here employed both REAT and MIRE (Microphone In Real Ear) test techniques to investigate the attenuation given by both passive and active noise protection devices when used in combination. The MIRE experimentation was carried out in noise fields up to 120dBA and the sound pressure level, in the earshells and ear canals, was monitored via miniature microphones and probe microphones fitted in personally moulded earplugs respectively. The study included testing on ten subjects, where all the hearing protectors were fitted as they would be used in the field. The MIRE and REAT experiments have both shown that headsets with varying performance of attenuation appear not to have a major effect on the overall attenuation when worn over earplugs and it is the performance of the earplugs that has a more direct effect on the attenuation of the double protection system. However, from direct measurements of the Sound Pressure Level (SPL) under the earmuffs during the MIRE procedure it can be concluded that the attenuation of the earmuff remains constant, implying that there is an interaction between earmuff and earplug that is leading to the degradation of the attenuation afforded by the double protection system.

Author

Hearing; Ear Protectors; Noise Reduction; Sound Pressure; Active Control

20060006313 Institute for Human Factors TNO, Soesterberg, Netherlands

A Microphone-Array-Based System for Restoring Sound Localization with Occluded Ears

Bronkhorst, Adelbert W.; Verhave, Jan A.; New Directions for Improving Audio Effectiveness; April 2005, pp. 20-1 - 20-7; In English; See also 20060006290; Original contains color illustrations

Contract(s)/Grant(s): N62558-02-M-6380; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Current helmets and hearing protectors interfere with the sound transmission to the ears and therefore affect the perception and localization of speech and other useful sounds. This can be a serious drawback especially when the person wearing the protection has to operate in complex, unpredictable environments. A novel electro-acoustic system for sound pass-through was developed that can make hearing protection acoustically transparent. By using external microphone arrays tuned to have a directional sensitivity similar to that of the open ears, the system can not only improve audibility of lowlevel sounds but also restore normal sound localization. The tuning was done by selecting specific microphone positions and by designing digital filters through which the individual microphone signals are passed. The system was evaluated in a sound localization experiment. Two versions were tested: one with individualized digital filters and one with universal (generic) filters. A comparison was made with a system with single external microphones, and with an earmuff with no sound pass-through. An open-ear condition was included as reference. Results show that, across all occluded-ear conditions, localization performance is best for the microphone-array system with individualized digital filters. Compared to listening through passive earmuffs, the percentage of confusions (quadrant errors) is nearly halved. However, localization performance is still not as good as with open ear

Author

Sound Transmission; Sound Localization; Microphones; Ear Protectors; Audio Equipment; Digital Filters

20060006314 Air Force Research Lab., Wright-Patterson AFB, OH, USA

3-D Audio: Military Applications and Symbology

Ericson, Mark A.; Simpson, Brian D.; McKinley, Richard L.; New Directions for Improving Audio Effectiveness; April 2005, pp. 22-1 - 22-9; In English; See also 20060006290; Original contains black and white illustrations; Copyright; Avail.:

CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Five experiments were conducted to study the acoustic attributes that enable the accurate identification and localization of rudimentary spatial warning sounds. In each experiment, two sounds were played simultaneously over loudspeakers at various azimuths and elevations. The stimuli consisted of pure tone complexes with a 13 kHz bandwidth. The fundamental frequencies, the amplitude modulation rate of the complex, the harmonicity of the carrier and modulation frequencies, and the coherence of the carrier and modulation phase were varied in the experiments. The combination of all the cues provided the best localization and identification performance. When and only when all cues were used, the subjects were able to accurately localize and identify the target sound.

Author

Amplitude Modulation; Warning Systems; Loudspeakers; Frequency Modulation; Military Technology; Display Devices; Coding

20060006315 Centre d'Enseignement et de Recherches de Medecine Aeronautique, Bretigny, France

Relative Effectiveness of Audio Tools for Fighter Pilots in Simulated Operational Flights: A Human Factors Approach

Hourlier, Sylvain; Meehan, James; Leger, Alain; Roumes, Corinne; New Directions for Improving Audio Effectiveness; April 2005, pp. 23-1 - 23-8; In English; See also 20060006290; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The French-Australian Collaboration on Emerging Technologies (FACET) investigated appropriate means of delivering situation-awareness into the cockpit of fighter aircraft under simulated operational conditions. Increasing use of audio has been suggested as a means to reduce visual workload, to enhance situation awareness, and mitigate the manual and cognitive demands of HOTAS and existing command-and-display concepts. An open design for the pilot interface should incorporate redundant information in the auditory and other sensory modes, while enabling commands to be delivered through voice or manual control interfaces. However, sensory and cognitive resource competition may still limit delivery of the implicit benefits of such a design. The objective of FACET was to investigate this proposition. Eight military pilots from France and Australia flew four full-mission scenarios in a simulated air combat environment. Auditory signals comprised radio messages, 3-D sounds and alarms, while the pilot's oral responses were verbal responses or direct voice inputs via automatic speech recognition. Some of the signals were drawn from those already in use, but all were selected for their potential to support situation awareness and support visual information, all delivered via a helmet-mounted display. The four scenarios had

specific, embedded combinations of events requiring activation of multiple resources. All events were videotaped. Both planned and unexpected events that were the outcome of human-interface interactions occurred. The pilots behaviour (e.g., tool selection, prioritization, errors) as well as their efficiency in processing inputs and output control were analysed in order to describe their cognitive resource management. Resource competition imposed by the new technologies was analysed. Interviews were also performed after each run. Following the simulation, Repertory Grids were constructed to elicit each pilot's cognitive representation of the control-and-display concepts. Pilot performance appeared to be independent of the time course of resource use during an event. Resource management was therefore not based on sequential allocation of resources, but rather on a cognitive prioritization of the task at hand. New audio technologies proved to be easy to use in conjunction with a broader use of the helmet-mounted display. Direct voice input required strict initial training to ensure reliability. Following such training, it was attractive to the pilots, even under high workload. The efficiency of 3-D sound was pilot dependent; one pilot in particular was able to fully use it immediately yielding a significant performance increase with a low cost in cognitive resources. In general, pilots' use of 3-D sound was dependent upon their level of training as well as their trust in, and willingness to experiment with the technology. These results may have implications for the training of pilots in the use of these new technologies.

Author

Human Factors Engineering; Helmet Mounted Displays; Display Devices; Fighter Aircraft; Pilot Performance; Voice Control; Verbal Communication; Speech Recognition; Auditory Signals

20060006317 Army Research Lab., Aberdeen Proving Ground, MD, USA

An Algorithm for the Accurate Localization of Sounds

MacDonald, Justin A.; New Directions for Improving Audio Effectiveness; April 2005, pp. 28-1 - 28-10; In English; See also 20060006290; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A computer-based algorithm that localizes sounds in near-real time has been developed. The algorithm takes input from two microphones and estimates the position of the sound source relative to the microphone array. The algorithm requires no a priori knowledge of the stimuli to be localized. The accuracy of the algorithm was tested using binaural recordings from a pair of microphones mounted in the ear canals of an acoustic mannequin. Sounds were played at 5 degree steps around the mannequin and the outputs were recorded at the entrance to each ear canal. These recordings were fed into the algorithm that estimated the location of the incoming sound on the horizontal plane. The algorithm utilizes a Head-Related Transfer Function (HRTF) to estimate the location of incoming sound stimuli. Although the HRTF of the acoustic mannequin was used, any HRTF can be inserted into the algorithm, allowing for predictions about individual performance differences. The results of this effort have been highly encouraging: the algorithm was able to identify accurately the location of a variety of sounds, committing an average of 2.9 degrees of unsigned localization error. Better than chance performance was found in noisy conditions of up to a -10 dB signal-to-noise ratio. The initial purpose of this algorithm is to predict the localization performance afforded by different types of combat helmets. Current and future encapsulating helmet designs are likely to impede localization performance, and an accurate localization model would be an invaluable tool in the helmet selection process. Adapting the model for use as a highly accurate machine-based localizer is an additional goal of this line of research. Applications for this technology include target tracking on unmanned vehicles, sniper detection, and machine-assisted sound localization.

Author

Algorithms; Sound Localization; Real Time Operation; Binaural Hearing

20060006318 Air Force Research Lab., Wright-Patterson AFB, OH, USA

Improving Multitalker Speech Communication with Advanced Audio Displays

Brungart, Douglas S.; Simpson, Brian D.; New Directions for Improving Audio Effectiveness; April 2005, pp. 30-1 - 30-17; In English; See also 20060006290; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Historically, most of the metrics that have been used to evaluate the effectiveness of military communications systems have focused on measuring the intelligibility of a single talker in the presence of a continuous noise masker. However, many critical military operations involve complex communications tasks that require listeners to monitor, process, and respond to two or more simultaneous speech signals. Many factors can influence performance in such tasks, including the relative levels of the competing talkers, the similarities between the voices of the competing talkers, and, in audio displays that allow the different channels of speech to be spatially separated, the apparent locations of the target and masking voices. In this paper, we present an overview of the factors that can influence speech intelligibility in multitalker listening environments, and

compare and contrast them to the factors that influence intelligibility in the speech-in-noise situations that are usually used to evaluate military communications systems. We also discuss the intelligibility benefits that can be achieved with advanced audio displays that use either dichotic or binaural processing to spatially separate the apparent locations of multiple simultaneous channels of speech. Finally, we describe a spatial configuration that has been shown to maximize the benefit of spatial separation in a listening configuration with up to seven simultaneous speech signals.

Author

Display Devices; Binaural Hearing; Telecommunication; Intelligibility; Continuous Noise; Target Masking

20060006320 AHAnalysis, Charlestown, MD, USA

A New Method for Rating Hazard from Intense Sounds: Implications for Hearing Protection, Speech Intelligibility, and Situation Awareness

Price, G. Richard; New Directions for Improving Audio Effectiveness; April 2005, pp. KN2-1 - KN2-24; In English; See also 20060006290; Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The auditory hazard assessment algorithm for the human (AHAAH), developed by the US Army Research Laboratory, is theoretically based and has been demonstrated to rate hazard from intense sounds much more accurately than existing methods. The AHAAH model operates in a PC level computer and analyses hazard in the time domain. In addition to reproducing the conductive path from air to the cochlea accurately it includes a non-linear stapes (clips large displacements) and an active middle ear muscle system. It is being written into a new US Army MIL-STD-1474(e) and is used by the Society of Automotive Engineers for the analysis of airbag noise hazard. The model shows that low-frequency energy at high levels can act to reduce the flow of energy into the inner ear, reducing the hazard. Traditional analyses tend to overrate the hazard from large calibre weapons impulses. The model also shows that impulses with little low-frequency energy, e.g. rifles, may be underrated in hazard by traditional methods. Hearing protective devices (HPDs), in order to be effective for gunfire type impulses, were shown to need most attenuation in the mid-range and less at lower frequencies, much like the attenuation curve for the non-linear combat arms plug. At the same time, speech intelligibility with such an attenuator could be much better than for an HPD with good low-frequency attenuation. Future developments of the model will include expansion to cover a wider range of intensities and an adaptive middle ear muscle system

Author

Ear Protectors; Intelligibility; Noise (Sound); Low Frequencies; Impulses; Hazards; Ratings

20060006321 Research and Technology Organization, Neuilly-sur-Seine, France

CONSTRAINTS and NEEDS in the Auditory and Vocal Environment of Modern Air Combat

Bigot, Frederic; New Directions for Improving Audio Effectiveness; April 2005, pp. KN3-1 - KN3-6; In English; See also 20060006290; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Today's missions become more and more complex. It is also mandatory to improve the ergonomics of the modern combat aircraft in order to minimize the pilot's workload. A good ergonomics must be intuitive, simple and reliable. Modern technologies bring military aviation the opportunity to improve the building of the Situation Awareness and the fighter aircraft cockpit's ergonomics. 3D sounds and vocal command technologies appear to be relevant as the complexity of the weapon system increases regularly. As a matter of fact, they must be implemented in the modern combat aircrafts.

Derived from text

Human Factors Engineering; Fighter Aircraft; Constraints; Auditory Stimuli; Voice Communication

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ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20060005769 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Soesterberg, Netherlands

Validation Competency Framework

vanBemmel, I. E.; vanGeel, B.; Langefeld, J. J.; December 2005; 64 pp.; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): TNO Proj. 013.64051

Report No.(s): TD2005-0424; TNO-DV3-2005-B219; Copyright; Avail.: Other Sources

The competency framework offers a valid structure to improve the validity and the application of competencies in human

resource management in two ways: 1) competencies provide more insight and are more easily measured and discussed, because of the description of competencies within the six competency areas of the competency framework, and 2) competencies can be applied more effectively in human resource activities.

Author

Resources Management; Human Resources

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ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

20060005706 Bureau of the Census, Washington, DC, USA

Economic Census 2002: Construction, Industry Series. Framing Contractors

Dec. 2004; 50 pp.; In English

Report No.(s): PB2006-103099; EC02-23I-238130; No Copyright; Avail.: CASI: [A03](#), Hardcopy

The economic census is the major source of facts about the structure and functioning of the nation's economy. It provides essential information for government, business, industry, and the general public. Title 13 of the USA Code (Sections 131, 191, and 224) directs the Census Bureau to take the economic census every 5 years, covering years ending in '2' and '7' The economic census furnishes an important part of the framework for such composite measures as the gross domestic product estimates, input/output measures, production and price indexes, and other statistical series that measure short-term changes in economic conditions.

NTIS

Census; Classifications; Construction; Construction Industry; Contractors; Economic Analysis; Economics; Industries

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20060005848

FOUR IRREGULAR GALAXY WITH MULTIPLE GAS CONDENSATION

November 2005; 3 pp.

Contract(s)/Grant(s): NAG5-13547; No Copyright; Avail.: CASI: [A01](#), Hardcopy

The first cluster, ABELL 1314, centered at 1h34m48.7s+49d02m25s, is a nearby cluster ($z=0.0335$). The cluster is clearly dynamically young with the X-ray peak north of the cD galaxy IC 712. At least five cluster galaxies are detected and bright in X-rays. The XMM observation is free of contaminating background flares, and has a clean exposure of 18.0 ks for MOS1/2 and 14.4 ks for PN. About 79000 counts in total (0.3-8 keV) are collected from the three instruments. We have examined the X-ray emission of the cluster galaxies, IC 712, IC 708 and IC 711. All three galaxies are radio head-tail galaxies, and the tail of IC 708 is especially dramatic with a 180 deg turn. Thermal soft X-ray emission, plus hard emission from the nucleus, is detected from all three galaxies. We plan to include the results of our analysis as part of our sample study of radio galaxies in nearby clusters. The work on the diffuse cluster emission is ongoing. The second target, ABELL 1589, centered at 12h41m35.8~+18d35m33s, lies at a redshift of $z=0.07357$. The X-ray emission peaks on the central galaxy MCG+03-32-084. After removing background flares, the clean exposures are: 17.0 ks for MOS1/2 and 9.0 ks for PN. About 37000 counts in total (0.3-8 keV) are collected from the three instruments. A radio head-tail source 4C +18.35, associated with the elliptical galaxy 2MASXi J1241003+183313 ($z=0.0739$), was discovered by Owen, White & Ge (1993). It is detected as an X-ray point-like source, but with a thermal emission spectrum. We plan to include it in our sample study of radio galaxies in nearby clusters. At least three other member galaxies are also detected in X-rays. There is an edge-like feature to the south of the cluster core, which indicates motion of the gas core. The work on the diffuse cluster emission is ongoing.

Author

Elliptical Galaxies; Emission Spectra; Galactic Clusters

99
GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20060005583 Royal Netherlands Meteorological Inst., Netherlands

Forensic Identification of Neat Ricin and of Ricin from Crude Castor Bean Extracts by Mass Spectrometry

van Baar, Ben L. M.; Hulst, Albert G.; de Jong, Ad L.; Wils, Eric R. J.; Fredriksson, Sten-Ake; Artursson, Elisabet; Nilsson, Calle; September 2005; 32 pp.; In English; Original contains color illustrations

Report No.(s): TD2005-0056; Copyright; Avail.: Other Sources

The glycoprotein toxin ricin, which originates from the seeds of *Ricinus communis* plants, has been the subject of increased interest, due to its potential terrorist use. Exceptionally, this toxin is also subject to the Chemical Weapons Convention. In this report it is shown that mass spectrometry (MS) can be used to unambiguously verify the presence of ricin in crude toxin preparations. It is demonstrated that matrix-assisted laser desorption/ionization (MALDI) MS can be used for screening, either by direct analysis or by trypsin digestion and peptide mapping. Purified ricin from several varieties of *R. communis* was characterized by liquid chromatography - electrospray tandem mass spectrometry (LC-ES MS/MS). A crude ricin preparation from a single bean was similarly characterized. A liquid Chromatography (LC) method was set up with product ion MS/MS detection of selected marker peptides specific for ricin: T5, T7, T11, T12, and T13 from the A-chain and T3, T5, T14, T19, and T20 from the B-chain. This method was then used to unambiguously identify ricin in a crude preparation of ricin. The MALDI MS molecular weight analysis and the marker peptides LC-ES MS/MS analysis give a forensic level of identification of ricin when combined with activity testing.

Author

Desorption; Toxins and Antitoxins; Seeds; Ionization; Mass Spectroscopy; Liquid Chromatography

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